Basic Elements of Filmmaking II Handbook

UW-Milwaukee Department of Film
Peck School of the Arts

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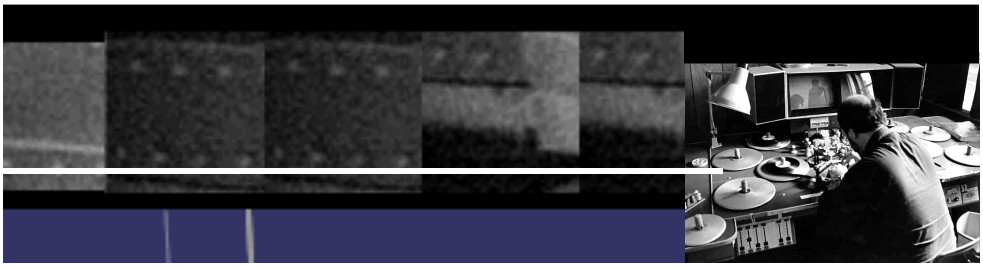


Notes on Creative Process – Lynn Kirby and Robert Nelson

"Taking her inspiration from observations of her daily life and surroundings, Kirby focuses on the exploration of quotidian events as a foundation for a broader understanding of the relationship between self and community. Her films are short, complex, multi-layered and evocative". Lisa Gibbs.

From "Time, Space and Knick Knacks," Interview with Lynn Kirby, " Lisa Gibbs, *Release Print,* 1993.

Sharon & the Birds on the Way to the Wedding by Lynn Marie Kirby

Pre-Production: Viewpoint

"My [works] are really made from confusion, the confusion coming from asking myself a question... I decided a while ago that using my own experience gives me a center to work from... My work focuses on how we live in time in just this way and how we tell in time,.. I do not wish to speak from a position of authority. I'm interested in opening up ways of seeing so that different ways of telling can be understood. I ask myself, 'What are my and my culture's expectations about this topic?'

"I need to get outside of the story a little bit to tell it. This can be accomplished by fictionalizing autobiographical material, by working with people who have different experiences from my own [and] by using found materials…I've found that people are really generous with the telling of their lives, stories and experiences. I become interested in *how* an experience in my own life mirrors a broader cultural experience through an examination of how I live and where I live...."

Production: Collecting, viewing, listening, collecting,..

"I'm usually collecting material as I'm thinking about new work-- reading writing, filming-- all at the same time-- all in the hope that in gathering material, I will make sense of the questions that motivated the piece in the first place. This is the method of *incremental shooting* which comes from me funding my own work. I shoot, look at the material and shoot again. This gives me the opportunity of rewriting.

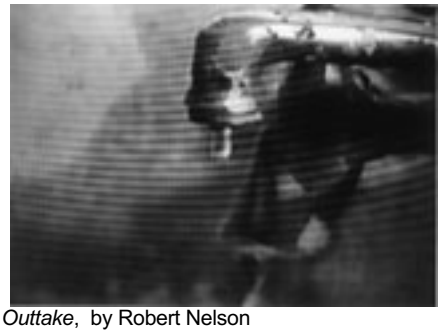
"I generally gather the sound and image at the same time. Its almost an endless process of observing, collecting editing and recollecting. I really do think of sound and image as two separate things.

Post-Production: Editing Image and Sound

"The sound is really a whole other narrative from... the images. The relation is not literal; the sounds and images actually compliment each other. There are moments of "sync"-- where little things come together and ground the image with the sound even while reminding the viewer of the separateness of their spheres…I also found that in telling my stories I needed to work with the language of the material as well as the ideas…What I give the viewer is really only half of it and my work asks that the viewer brings his/her experience to the piece." From "Time, Space and Knick Knacks," Interview with Lynn Kirby, " Lisa Gibbs, *Release Print,* 1993.

Bob Nelson: Where Film Ideas Come From

"Ideas come from different, unexpected places…If you strain too hard for ideas the film will show your lack… The most reliable place for ideas to come from is from the work itself…You only need one small idea to start…Don't be too hard on yourself or prejudge your idea. Once you have started, you can re-evaluate things when you need to. Drop an idea for anything better that comes along but there must be at least two, good reasons before changing, dropping or modifying it… A newly started, newly achieved beginning spawns completely unexpected ideas… Follow the ones that seem worthy, but if you take a wrong turn, don't be afraid to go back or even start over. This is another good reason to keep your ideas simple… An idea is a guide to your work. Don't make the idea so important that you can't change it or be open to changing it for the better. The work itself suggests what is appropriate…Some ideas come from trying to fix disappointments….Editing itself is to some degree fixing (improving by change and deletion)…If, in trying fixing something, you find that you are changing your basic idea for the worse, its better to leave the material broken… Don't spend too much time thinking; the most important practice for a filmmaker is making. If you concentrate on making, the thinking occurs on its own. The best painter I know of learned to paint by painting, painting, painting-- good or bad, he just kept painting. He wasn't afraid to fail and so began to learn things through his hands and his heart. He learned perseverance and automatically, he got better."



Outtake, by Robert Nelson

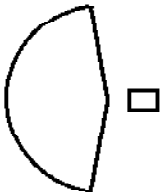
– From an interview with Bob Nelson by Jack Cronin in Spring, 1999.

Principles of Cinematic Exposures

Exposure is a function of two variables: the elapsed ***Time*** during the exposure and the ***Intensity*** of the light reaching the film stock. The amount of light energy needed to produce the desired exposure is also affected by the *Exposure Index* (EI) of the film stock. For camera stocks, this number reflecting light sensitivity is usually provided by the manufacturer.

Time

The duration of the exposure of each frame of film is established by the ***filming speed***. As a Bell & Howell 70DR camera runs, a disk shaped shutter with a 205 degree opening rotates at the rate of 1 revolution per frame.



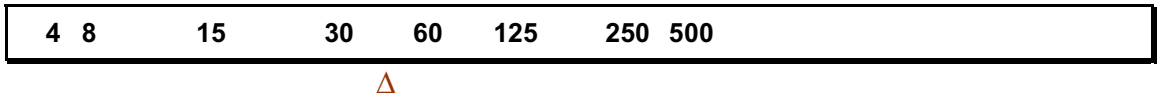
With each revolution of the shutter, the opening permits light to pass momentarily. The length of exposure (in seconds or fractions of seconds) that each film frame receives is called the *shutter speed.* Shutter speed is calculated by this equation:

$$\frac{1}{\text{Filming Speed}} \times \frac{\text{Shutter Angle Opening }^\circ}{360^\circ} = \text{Shutter Speed}$$

For a Bellow & Howell 70 DR running at 24 F.P.S the shutter speed computes:

$$\frac{1}{24\ \text{FPS}} \times \frac{205^\circ}{360^\circ} = \frac{1}{42}\ \text{Second}$$

And this duration is approximated at this position on the light meter scale:



As the shutter speed equation indicates, the FPS setting or filming speed affects exposure. When the filming speed is increased above the normal 24 FPS rate, the revolving shutter spins faster producing shorter exposure times. Inversely, as the camera speed is lowered, the shutter spins slower and exposure time per frame is increased.

This simple relationship can be used to quickly compute the shutter speed for rates other than 24 FPS. For example, its fairly easy to deduce that if the camera speed is increased from 24 FPS to 48 FPS, the amount of time for each revolution would be cut in one-half.

$$\frac{1}{42} \times \frac{1}{2} = \frac{1}{84}\ \text{Second}$$

If the camera is slowed down from 24 FPS to run at 12 FPS, the exposure time is *doubled:*

$$\frac{1}{42} \times \frac{2}{1} = \frac{2}{42} \text{ or } \frac{1}{21} \text{ Second}$$

By memorizing the shutter speeds for 24 FPS and 32 FPS and applying following the simple proportion rule, the other shutter speeds can be quickly deduced in the field.

Calculating Shutter Speeds for the Bolex Reflex

About 20% the light passing through the lens is used for reflex viewing on Bolex Rex models. The simplest way to account for this loss of light when calculating exposures is to use an "effective" faster shutter speed.

Rex models have three shutter angle opening positions ranging from 130 degrees (fully open) to 33 degrees ("1") position. With the variable shutter set at the maximum angle opening and the filming speed at 24 fps, the "real" shutter speed would be 1/65 second, but the 20% loss of light creates an effective shutter speed of 1/80 second.

$$\frac{1}{24 \text{ FPS}} \times \frac{130°}{360°} = \frac{1}{65} \textbf{ - 20\% light = } \frac{\mathbf{1}}{\mathbf{80}} \textbf{ sec.}$$

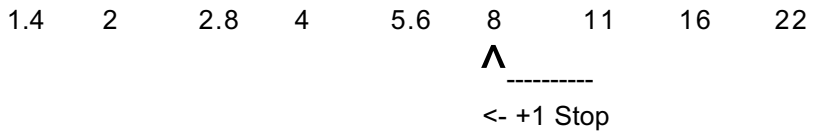
	variable shutter **open** 130°		variable shutter at **1/2** 65°		variable shutter at **1** 32-35°	
fps	real	**effective**	real	**effective**	real	**effective**
12	1/33	**1/40**	1/45	**1/55**	1/75	**1/94**
16	1/45	**1/55**	1/60	**1/75**	1/100	**1/125**
18	1/50	**1/60**	1/70	**1/87**	1/110	**1/137**
24	1/65	**1/80**	1/90	**1/112**	1/150	**1/163**
32	1/90	**1/110**	1/120	**1/150**	1/200	**1/225**
48	1/130	**1/160**	1/180	**1/225**	1/300	**1/375**
64	1/180	**1/220**	1/240	**1/300**	1/400	**1/500**

Single frame rate: real: 1/30 second **effective: 1/40 second**

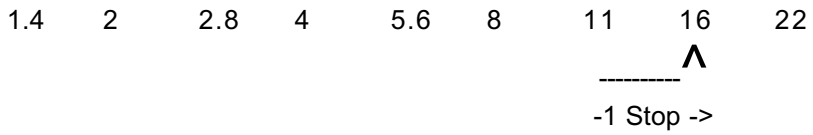
Light Intensity

The second variable of exposure, *intensity,* is controlled by the aperture ring on the camera lens. The numbers on or beside the aperture ring tell the camera operator how much light the lens is passing. The key to using this rather odd sequence of numbers relies on the concept of the *Stop.* Each step between aperture numbers represents a potential change in

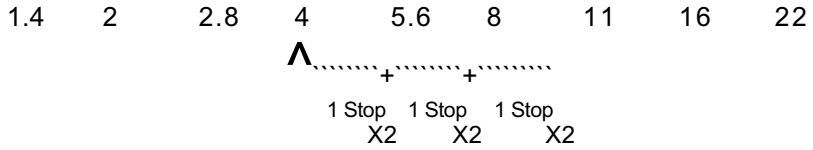
light intensity of one *Stop*. With each Stop, the intensity of the light changes ***by a factor of 2.*** . Depending on the direction the aperture ring is moved, the light intensity is either doubled or cut in half with each Stop. For example, when the aperture setting is moved to a *smaller* number-- say from F11 to F8-- light intensity passing through the lens and reaching the film increases by 1 stop.



Conversely, light intensity is cut in-half when the aperture is changed one step to a *larger* number:

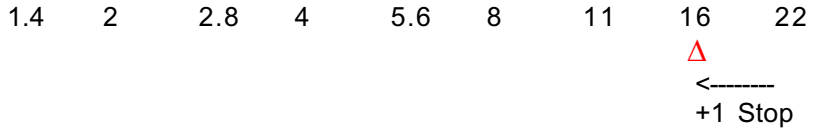


When making in the field exposure adjustments, it is easier to compute the affect of each Stop one at a time. For example: How much will the light intensity change when the lens aperture is moved from F11 to F4? Answer: It is increased 2 X 2 X 2 or 8 times. The light intensity doubles with each Stop moved:



Familiarity with the variables that affect exposure decreases the likelihood of making errors in logic. Here's an example. To create a "day for night" effect, the American Cinematographer manual suggests under-exposing a low contrast outdoor scene by two stops. You have been shooting a scene at F22 at 24 fps to create this effect. Now you want to shot the final shot in slow motion at 48 fps. In order to perfectly match exposure of the 24 FPS material, what aperture should be used?

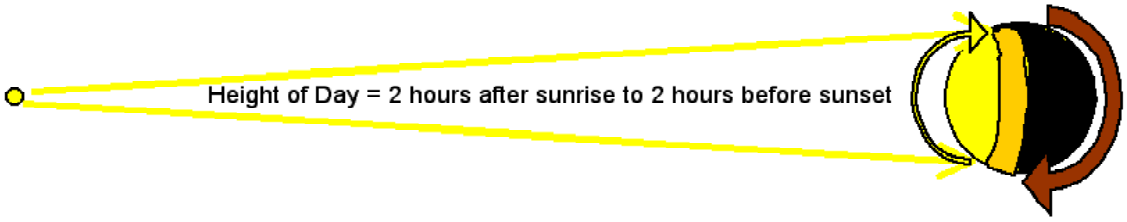
One might be tempted to look-up the shutter speed for 48 FPS and re-read and extrapolate the numbers on the light meter, but this approach introduces more possibility of an exposure mismatch. It is easier and more accurate to simply note that 48 FPS is twice a fast at 24 FPS and make a one Stop correction. In which direction should the aperture setting be moved?



By opening the lens one stop, twice as much light will reach the film to compensate for the reduction of exposure time per frame by one-half. Note that no additional correction is needed for the "day for night: effect because this adjustment was inherent in the F22/24 FPS setting which is to be matched.

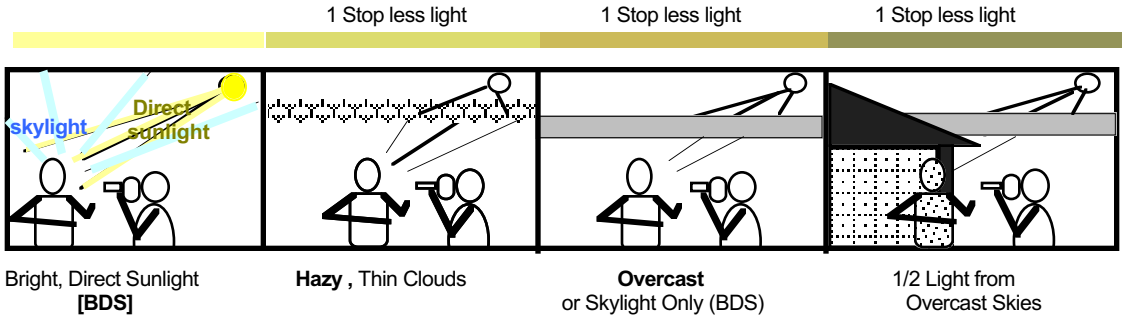
Working with Known Light Intensities

At a distance of 93,000,000 miles, the sun produces a steady field of light through which earth passes. The amount of light reaching the surface is quite consistent during *the height of day* which starts about 2 hours after sunrise and continues until 2 hours before sunset.



The range in intensities during the height of day can be simplified to three basic conditions.

- When sunlight passes through HAZY SKIES, its intensity is cut in half-- or is reduced by one STOP.
- When the light from the sun must passes through fully OVERCAST SKIES, the intensity of light is reduced another STOP.



As illustrated as BDS, on days with Bright, Direct, Sunlight, the light reaching objects on the earth's surface comes from two sources: (1) *direct sunlight* and (2) sunlight reflected from the earth's atmosphere. This later component has about 25% of the intensity of direct sunlight and is called *skylight.*

Hazy skies are typified by high, thin, often uneven clouds with some direct sunlight creeping through. Overcast conditions can be recognized by uniform clouds and lack of shadows. Under overcast conditions where the light comes from all points of the sky, one can even account for obstructions like porch covers that shade a subject from half of the sky's available light resulting in the loss of another stop of light.

Using the Daylight Exposure Law

With the knowledge of your camera's shutter speed, your film stock's exposure index and the intensities of light you are working with, its possible to make perfect exposures without the services of a light meter, especially during the height of daylight.

When film stocks began to be produced industrially, the manufacturers used the consistencies of daylight to establish numerical ratings for the sensitivities of their films that these early professionals could relate to. These numbers survive today as A.S.A., E.I. or

Exposure Index. The manufacturers assigned a film stock a number relating to the exposure time necessary to create a good image under Bright Direct Sunlight when the aperture setting was F16. If a film stock produced good results when the exposure duration was 1/50 second, the reciprocal value of "50" was assigned.

This relationship can be expressed at the *Daylight Exposure Law:*

> *The proper exposure in Bright,Direct Sunlight is F16 when the reciprocal of the shutter speed is equal to the Exposure Index of the Film stock.* (The reciprocal of Y is 1/Y. The reciprocal of 1/48 is 48, etc.)

In addition to avoiding exposure meter miscalculations, using of the exposure law encourages one to learn to *see* and evaluate light more carefully.

Some Examples of the Exposure Law

Determining the correct F Stop setting under daylight conditions may be a fine art of perception but the arithmetic involved is quite simple. This is due primarily to the fact that the filmmaker needs only to determine an aperture setting within the accuracy of a Stop and a Stop produces a change of doubling or halving the intensity of the light reaching the film! This permits a lot of "rounding-off" in the computations with no significant impact on exposure.

The best way to learn how to use the Exposure Law is to follow some in-the -field examples. In the below examples, the filmmaker seeks the proper F-Stop setting without the use of a light meter under bright direct sunlight conditions. The method involves a sequence of short questions.

Example 1
Light Conditions: Bright Direct Sunlight (BDS)
Plus-X-Reversal in Daylight : EI = **50**
Bolex Rex Shutter Speed @ 16 FPS: **1/55 sec**

1. Is the reciprocal of the shutter speed (84) equal to the EI of the film (50)?
*Answer: Yes. The proper F-Stop would be **F16.***

Example 2
Light Conditions: Bright Direct Sunlight
Tri-X-Reversal in Daylight : EI = **200**
Bolex Shutter Speed @ 32 FPS: **1/110** Second
What is the proper **F-Stop?**

1. Is the reciprocal of the shutter speed (110) equal to the EI of the film (200)?
Answer: No .

2. Is the film stock more sensitive or less sensitive than one in which the proper F-Stop would be F16?
Answer:: More sensitive .
(200 is larger than 110)

3. If the answer is *more* sensitive, the aperture will have be *closed down* from F16 to let in *less* light.

4. Divide the larger of the numbers (In this case "200") by 2 in separate steps until the numbers are approximately equal.

Answer: .200 /2 = 100. 100~110.

5. For every step that you divided the larger number by two, close-down the lens aperture one full Stop-- counting from F16.

Answer: 1 "divide by 2 " step..

*Close-down lens 1 stop from F16. Set Lens to **F22.***

Example 3

Lighting Condition: Bright Direct Sunlight (BDS)
Plus-X-Reversal in Daylight : EI = **50**
Bolex Shutter Speed @ 24 FPS: **1/80** Second
What is the proper **F-Stop?**

1. Is the reciprocal of the shutter speed (80) equal to the EI of the film (50)?

Answer: no

2. Is the film stock more sensitive or less sensitive than one in which the proper F-Stop would be F16? *Answer: Less sensitive.*

3. If the answer is *less* sensitive, the aperture will have be *opened up* from F16 to let in *more* light.

4. Divide the larger of the two numbers (in this case "80") by 2 in separate steps until the numbers are approximately equal.

Answer: 80 /2 = 40. 40~50

5. For every step that you divided the larger number by two, open-up the lens aperture one full Stop-- counting from F16.

*Answer: 1 "divide by 2 " step means open-up the lens 1 stop from F16 to **F11.***

Example 4

Bright, Direct Sunlight
7362 High Contrast Positive in Daylight : EI = **12**
Bolex Shutter Speed @ 12 FPS: **1/40** Second
What is the proper **F-Stop?**

1. Is the reciprocal of the shutter speed (40) equal to the EI of the film (12)?

Answer: No

2. Is the film stock more sensitive or less sensitive than one in which the proper F-Stop would be F16?

Answer:: Less sensitive .

A Film stock EI of 12 s less than 40, the reciprocal of the shutter speed

3. If the answer is *less* sensitive, the aperture will have be *opened-up* from F16 to let *more* light pass.

4. Divide the larger number by 2 (in separate steps) until the numbers are approximately equal.

*Answer: .40/2 = 21.....*and *...*
20/2 = 10 .
10 ~12.

5. For every step you divided the larger number by two, open-up the lens aperture from F16 one stop.

Answer: 2 steps.
Open-up lens 2 stops from F16. Set Lens to F8.

When outdoor lighting is less intense than Bright Direct Sunlight (BDS), the computation is conducted in the same way and then the adjustment for the overcast conditions is added at the end:

Example 5
Lighting Conditions: **Overcast**
7362 High Contrast Positive: EI = **12**
70DR Shutter Speed @ 24 FPS: **1/42** Second
What is the proper **F-Stop?**

(Answers to steps #1-5 same as for BDS in Example 4 above)

1. Is the reciprocal of the shutter speed (40) equal to the EI of the film (12)?

Answer: No

2. Is the film stock more sensitive or less sensitive than one in which the proper F-Stop would be F16?

Answer:: Less sensitive .
A Film stock EI of 12 s less than 40, the reciprocal of the shutter speed

3. If the answer is *less* sensitive, the aperture will have be *opened-up* from F16 to let *more* light pass.

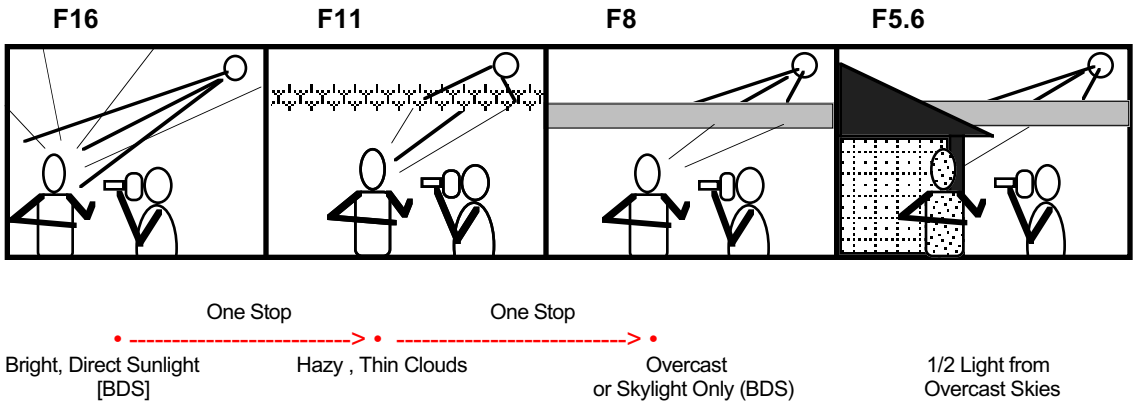
4. Divide the larger number by 2 (in separate steps) until the numbers are approximately equal.

*Answer: .40/2 = 21.....*and *...*
20/2 = 10 .
10 ~12.

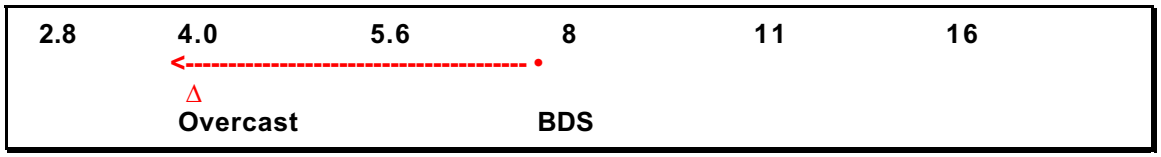
5. For every step you divided the larger number by two, open-up the lens aperture from F16 one stop.

Answer: 2 steps.
Open-up lens 2 stops from F16. Under BDS, you would set lens to F8.

6. Refer to the Daylight Illumination Chart on the next page. In our example, the lighting is not under BDS but overcast. To convert our computations thus far to these conditions, we need to take into consideration how much less light there is than BDS, in Stops.



Answer: Overcast skies provide 2 Stops less light than BDS. To convert for these conditions., open-up lens 2 stops from previous computed value of F8 to F4 :



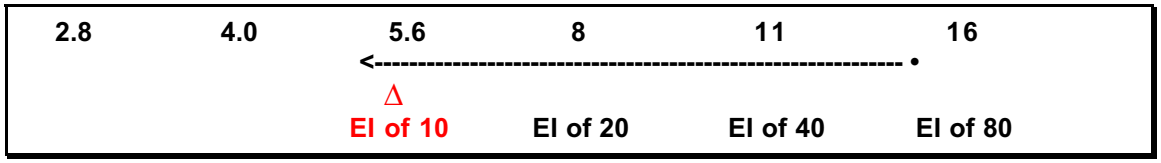
The exposure law can also be used to compute the Daylight EI rating of a print stock film for which no EI number is published. First, a test must be run under bright, direct sunlight conditions. Expose a bit of film (at one shutter speed) under all of the F-Stop settings from F22 to F2. Process the film and determine which F Stop setting produces the best results. The EI is computed backwards from the number of stops away from F16:

Example 6
Best Result achieved at F5.6
Lighting Conditions: Bright, Direct Sunlight
7302 Positive
Bolex Shutter Speed @ 24 FPS: **1/80** Second
What is the daylight **EI** of the print stock?

1. Is the best exposure produced at F16?
   Answer: No..
   (If yes, then the EI is equal to the reciprocal of the shutter speed).

2. Count the number of stops between the F-Stop setting of the best exposure and F16.
   Answer: 3

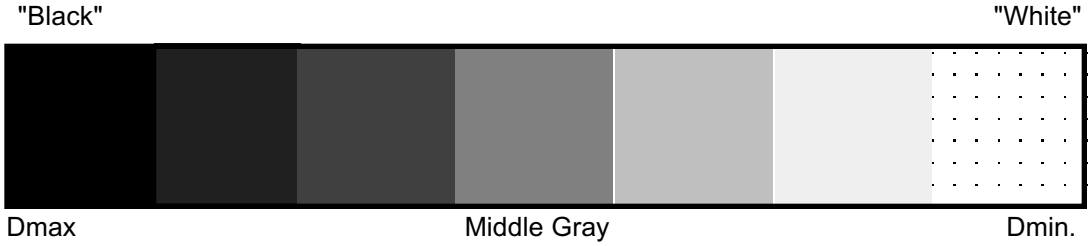
3. If the best exposure was produced at a *larger* aperture than F16, then the film stock is three stops less sensitive than 80 or (1) 80/2 (2) 40/2 (3) 20/2 =**10.** The film stock seems to have an exposure index in daylight of 10.



Exposure: Density, Latitude & Metering

Density

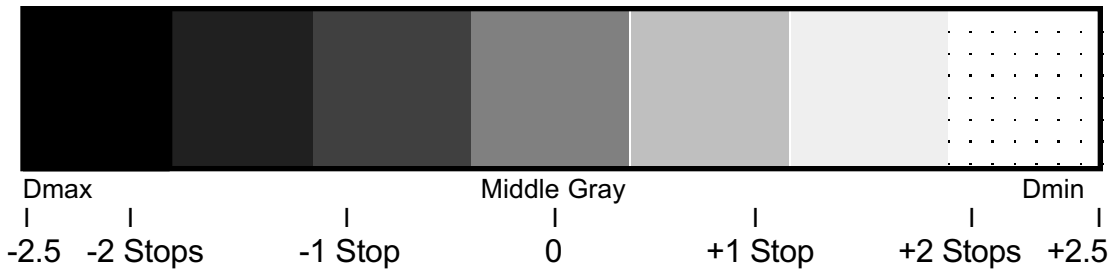
The "black," "grays," and "white" of projected Black & White film are the result of a range of *densities* of silver particles embedded within the gelatin emulsion. The darkest or densest "black" produced by a film stock is called the *Dmax* (Density-Maximum). The brightest "white" produced by clear film is called the *Dmin*. (Density Minimum). In between, there are several values from dark gray to light gray. In the middle of this "gray scale" is a theoretical value called "middle gray." This value is defined as having an equal number of lighter gray and darker gray values on both sides.



Exposure Latitude

An ideal B/W film stock would be able to faithfully reproduce all of the many light intensities existing in the world. In reality, Plus-X and Tri-X-Reversal film stocks are able to reproduce only a small range of light intensities at one time. This range of light intensities which a particular film is capable of reproducing is known as its *Exposure Latitude.* Plus-X and Tri-X Reversal have exposure latitudes of about 5 stops. This means that dimmer or brighter light intensities outside of this 5 stop range will be reproduced only as "black" or "white" and not as additional values.

Plus-X and Tri-X 5 Stop Exposure Latitude



Knowledge of a film stock's exposure latitude is very helpful when trying to reproduce a surface or object as a specific tonality in the film image or control contrast with artificial lighting. More on these techniques after a review of light meter basics.

Using A Light Meter

CdS and Photoelectric

In the Film Department we currently have three light meters: The Gossen Pilot II, the Sekonic LC128 and the Gossen Luna Pro. The first two meters photoelectric and the Luna Pro is a CdS design meter. The photoelectric design converts light energy directly into electricity causing the meter needle to move proportionally. The CdS design uses a built-in battery and the light modulates this existing current.

It is the simple duty of a light meter to measure the intensity or energy of the light falling on its sensor. Both CdS and photoelectric designs provide accurate measurements under daylight and bright studio conditions. Under low light conditions, however, photoelectric meters like the Gossen Pilot II and Sekonic LC128 often provide erratic or inaccurate readings. When shooting with 4 or fewer foot-candles of light, one should use a CdS light meter or at least check the reading with another photoelectric meter. Many 35mm still cameras have built-in CdS light meters or the filmmaker can conduct an exposure test before quantities of film are risked. [Note that the last 10 feet on a roll of film can be used to test several aperture settings per location because it only takes a short burst and few frames for evaluation on a light box or viewer. When conducting an exposure test, bracket the estimated aperture setting two Stops on both sides in 1/2 or 1 Stop steps. Don't forget to unload the camera roll in complete darkness or the tests may get flashed!]

The light meter is a very powerful tool when coupled with an observant user who records descriptions of lighting situations and the aperture/fps used. Experienced cinematographers often carry small notebooks to record their exposures so the good results can be repeated. This technique greatly improves one's ability to judge lighting and exposure requirements. In making notes, record the type/wattage of light(s), the position and distance of the light(s) in relation to the primary object being filmed and camera factors like filmstock type/E.I., aperture setting, filters, FPS setting and variable shutter settings.

Incident or Reflected?

All of the meters in the Department can be used for incident and reflected readings with a small adjustment to the housing. Both designs have strengths and weaknesses and If you understand how to use them both, you should get very similar readings.

Incident Light Metering

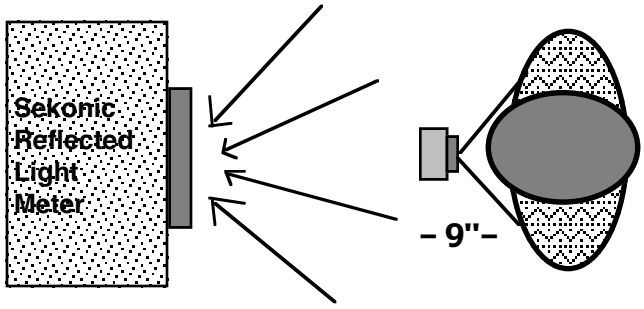
Some lighting situations are a bit easier to accommodate with an incident light meter. A studio set with familiar costumes, props and light fixtures would be a good example. The hemispheric receptor averages the intensities of light coming from several directions and assumes that the surface or object being filmed is close to middle gray or 18% reflectance-- the standard for middle gray rendering. The incident meter is positioned next to the object or subject and pointed at the camera.

Because an incident light meter measures only the light falling on the receptor, it does not take object or surface characteristics into consideration. An incident meter can be moved around within the scene to measure intensity at different positions, but it has no way of knowing whether the light is illuminating a light, medium or dark surface. As the film in the camera receives the light *after* it interacts with a surface, its easier for beginners to use reflected readings in calculating exposures. But good exposures still take some practice with basic techniques.

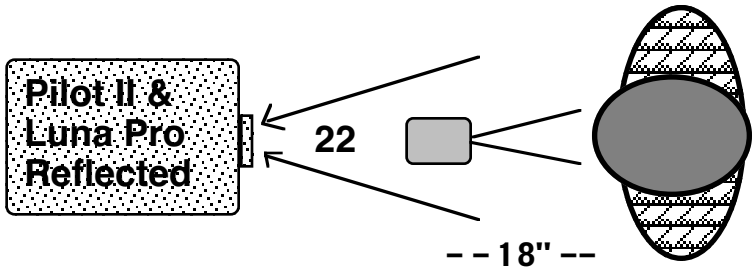
Reflected Light Metering

If a reflected light meter could speak, it might say, "I see Middle Gray." Therefore, when learning to use a reflected light meter, one can simply make sure that the light the meter is close to and

pointed at the surface one wishes to render as a middle gray value. When rendering faces and other surfaces with detail is a priority, the light meter can be held as close as a few inches away-- just make sure the meter or operator does not block any of the light from the area that being is measured. The Sekonic light meter accepts light from a fairly wide angle so close placement will improve accuracy when reading smaller areas.



The Pilot II and Luna Pro reflected meters accept light from an angle of about 22 degrees-- about the same angle of coverage as a normal, 25mm lens.



When taking light readings for wide shots like landscapes, one can stand near the camera and point a reflected meter towards the landscape for an "averaged" reading. You can also can pick-out a surface within the setting that you want to render as middle gray and take a close-up reading.

Applying Latitude in Determining Exposure

In our film studio, students spend considerable time adjusting the lights to render just the right amount of the shadow. For a scene with pronounced shadows in mind, close-up reflected light readings from the brightest surfaces might be 3-5 Stops higher than ones taken from the darkest surfaces. Under such lighting, with Plus-X or Tri-X film, all of the reflected light intensities would fall within the exposure latitude of five stops. Assuming the correct aperture setting is made, the darkest shadows in the scene would be rendered "black" and the brightest areas reproduced as "white." When the extremes of reflectance are encompassed in this way, a maximum number of gray values are rendered and image detail is maximized.

Cinematographers and still photographers describe this phenomenon as *full tonality.* The effect is somewhat independent of lighting contrast by emphasizing the control of reflectance extremes.

Achieving full tonality when filming outdoors is much more difficult. Not only are the light sources difficult to alter, but the range of reflected values produced are often much wider. Under BDS lighting conditions, it is not uncommon for the brightest surfaces in a landscape to reflect 10 Stops more light than the darkest ones. Regardless of aperture setting, a lot of scene detail will not be

rendered within the 5 Stop exposure latitude of Plus-X or Tri-X. This wide range of reflected values is often the result of uniform, harsh sunlight and objects such as trees and buildings with deep "over-hang" creating deep shadows. The presence of the sky within the frame adds a very high reflectance extreme under BDS conditions as well.

This is why many outdoors shots made with Plus-X or Tri-X have a "washed-out," flat appearance-- the reflectance intensities are much wider than the 5 Stop exposure latitudes. Interestingly, if the developing cinematographer learns to create full tonality images with Plus-X or Tri-X, she or he will be extremely competent when working with color negative film stocks. These stocks have exposure latitudes in the 6 to 10 Stop range.

Under-Exposure with Reversal Films

The tonalities in positive photographic transparencies like black & white reversal film are the result of silver particles embedded in the emulsion after processing. In effect, the "information" that the image holds is created by differing concentrations of these particles.

When estimating F-Stop settings for reversal filmstocks, darker exposures allow more particles to remain on the processed film and lighter exposures cause more particles to be removed. (For example, a scene exposed at F22 will appear darker than a scene exposed at F16.) Because full tonality is achieved within a relatively small F-Stop region (usually within about 1/2 Stop or so) , many filmmakers tend to compute settings which err towards under-exposure rather the over-exposure. The logic is that under-exposure preserves particle density -- the "information" of reversal images. When working with scenes that have a wide range of reflected light intensity, cinematographers often shoot with an aperture setting that will under-expose the whole scene by 1/2 to 1 Stop. This can be computed by taking a reflected light reading from a characteristic middle-gray surface (like a face) and stopping down 1/2 to 1 Stop from the F-Stop number indicated by the meter scale.

Now lets look more carefully at light-metering and the computation techniques involved. Following is a production situation where readings, latitude and lighting adjustments are used to create the desired densities.. Can you "walk-through" some other examples?

Metering, Latitude & Lighting

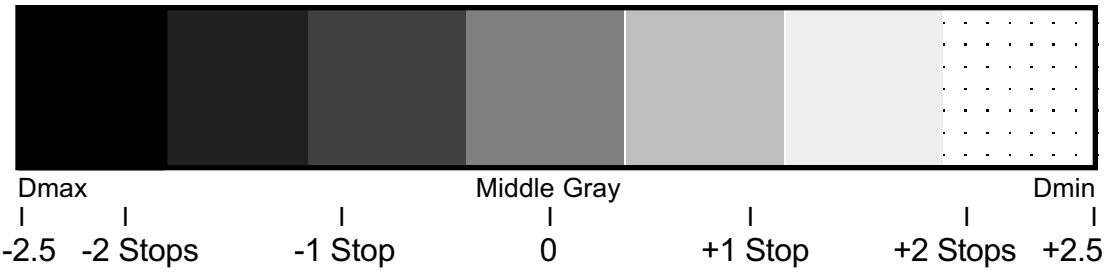
Production Narratives

Example 1. You are doing a shoot in a big factory on an overcast day with Plus-X-Reversal film, a 70DR and a tripod. The scene occurs in a big empty room with a long line of big windows along one wall. The first shot is a medium shot of your actor walking in front of a window in silhouette. To remain consist with the tonalities of other shots in the film, the area around the person should be rendered "white" (clear) while the figure is rendered solid black. By carefully positioning the tripod a composition is achieved where the window is filled only with even, gray sky. You begin the light metering process:

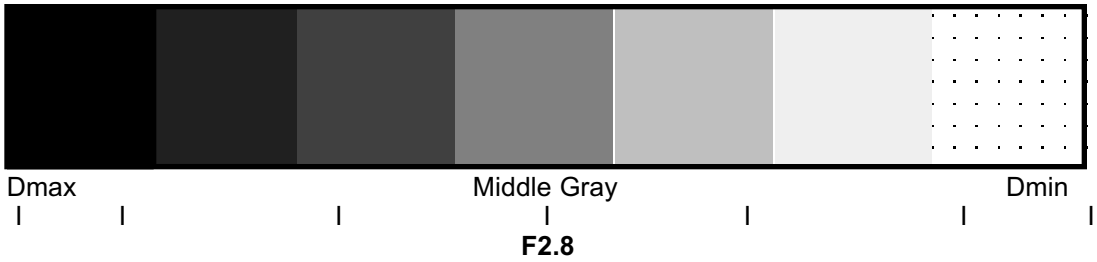
- When the figure is standing 3' from the window, a close-up reflected reading from the shaded side of the face reads F2.8.

- Using the "I see middle gray" principle of reflected light readings, you deduce that an exposure made at F2.8 would render the shaded side of the face middle gray. This is not what you want; you want it to be black and you know that this will require closing the aperture down from F2.8, but how much? This is where visualizing the filmstock's exposure latitude becomes very helpful.

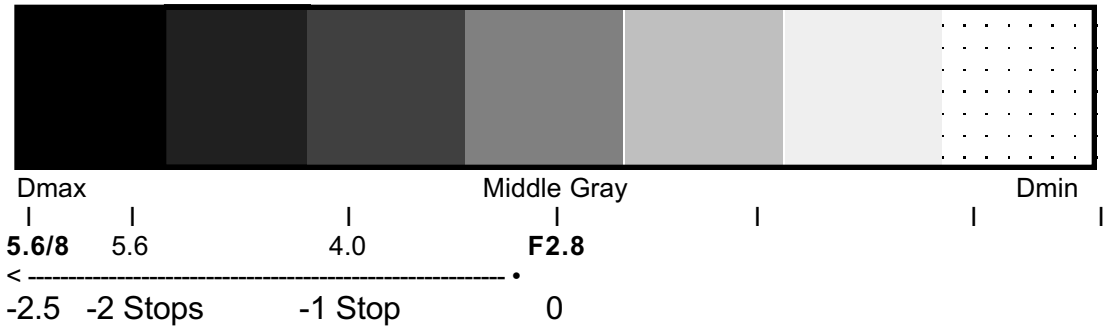
Plus-X- Reversal 5 Stop Exposure Latitude



- Your light meter says that F2.8 would render the face as middle gray so you visualize a chart and place F2.8 in the middle gray position:

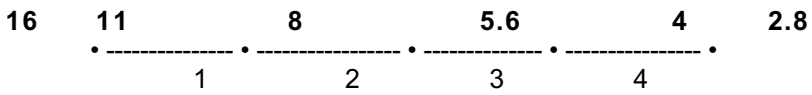


- Closing the aperture will result in increased film density and opening will result in less density. With this concept in mind, you can then imagine closing the aperture and the effect it will have on density:



- By closing the lens from F2.8 to F 5.6/8 split (halfway between F5.6 & F8) the face will receive 2.5 stops less rendering this surface as the Dmax, or "black." What about the window, what value would it be rendered at F 5.6/8 split?

- To achieve the stark, high contrast effect desired, we can imagine that the light from the window must be 5 or more Stops brighter than the light reflected from the shaded side of the subject's face. A reflected reading of the sky taken through the window reads F11. Using an aperture scale as a familiar reference , how many stops separate the two readings?



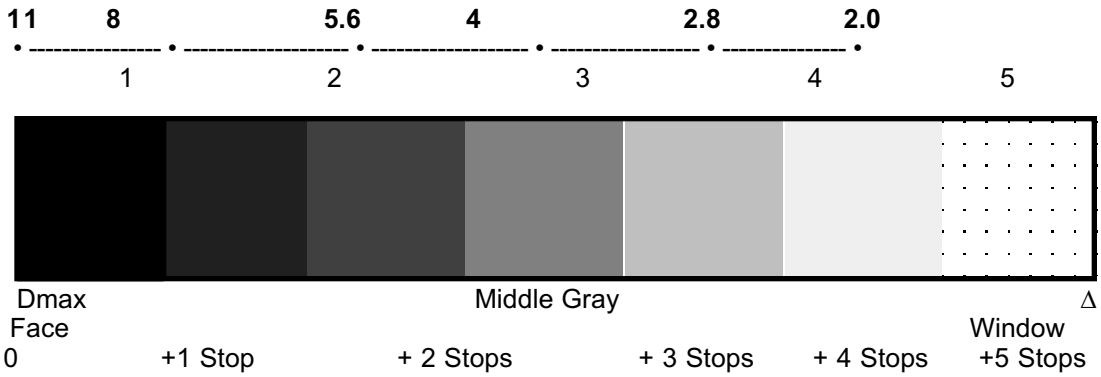
- Will a difference of four Stops render the shaded side of the face and the sky near (or beyond) the Dmax and Dmin of the 5 Stop latitude?

- With the window four stops lighter than the face, it would be rendered as light gray. What simple adjustment could be made to increase the difference in illumination between these surfaces? Here, a basic rule of tonality control applies:

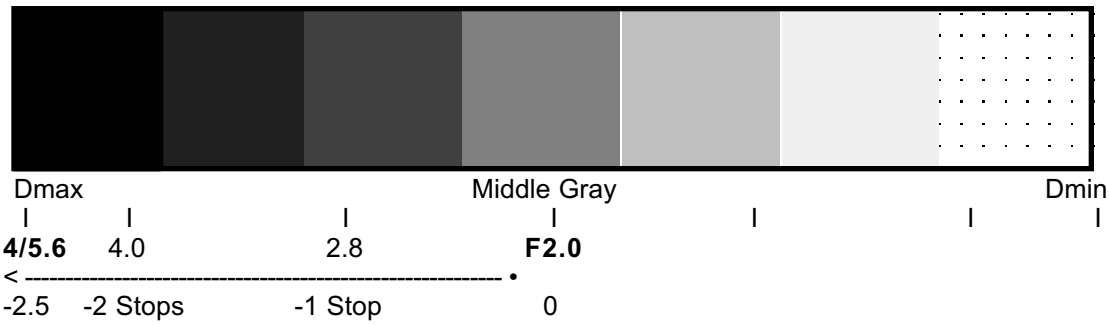
If you can't move the light, move the subject. If you can't move the subject, move the light.

- By moving your hand in front of the subject's face, the light illuminating the shaded side seems to be coming mostly from the concrete floor. The light from the floor comes from the daylight entering the window? Can't change the light source too easily. How about moving the subject.

- The subject is moved another 3 feet away from the window and the shot re-framed. Now a reflected light reading from the shaded side of the face reads F2.0. Will this be enough difference?



- Now that the lighting range is adjusted, we're ready to compute the F-Stop to use for the exposure. The new reflected reading from the subject's facewhich we wish to render as "black" reads F 2. What aperture setting will render it "black?"



- Set the aperture at F4./5.6 split.

Optics and Cinematography

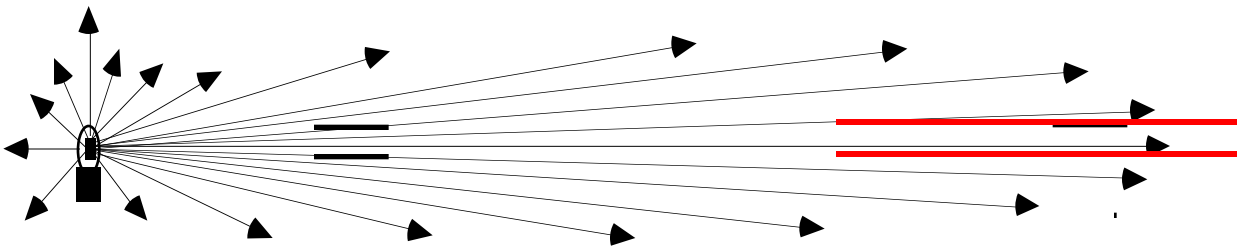
Part of the magic of film is that it simplifies visual experience. This is particularly evident in its inability to portray subtlety of tone. The heightened contrast emphasizes the role of light carving a deeper impression in the psyche.

The decisions of a cinematography revolve around the use of light. Whether starting from scratch with artificial light fixtures in a studio or chasing a profound moment of natural light in the field, an awareness of the underlying principles makes the decisions more engaging.

Coherent Light

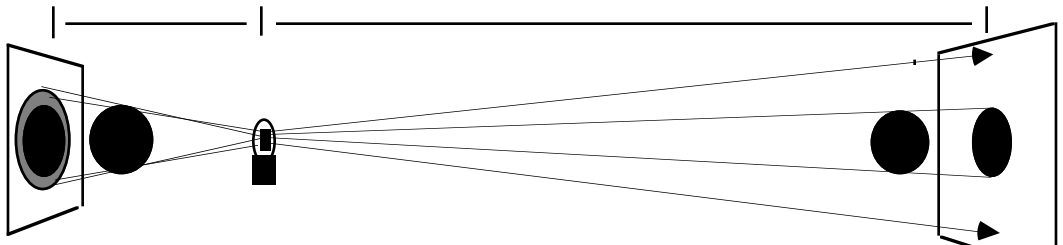
There are two basic formations of light energy: *coherent* and *diffuse.*

When light is generated at a point source, energy is emitted uniformly in all directions. This is sometimes imagined as many "rays" of light "moving" away from the source in perfectly straight lines. The further the rays travel from the source, the more similar in direction their paths become. The further light travels from its source, the more parallel, or coherent the “rays” become.



As the distance from the source increases, the rays become more parallel-like.

Assuming that the light passes uninterrupted, this "parallel-like" nature, or coherency, is responsible for producing shadows with sharper edges. Note that the shadows are sharper when formed at a greater distance from the light source.



Less sharp shadow produced nearer the Light Source.

Shadow is sharper when the object is a greater distance from Light Source.

Creative Use of Coherent Light

Shadows and texture. Coherent light is excellent for forming deep, pronounced shadows on 3-D objects and enhancing texture on rough surfaces. Surface textures become even more evident when the light is raked-- or directed along the plane of the surface. For filming extreme close-ups of skin, leaves and other uneven surfaces, coherent light will show more detail. Landscapes have more texture and depth when filmed in the morning or late afternoon-- especially at a 90 degree angle to the light. Whenever you want the light to cast crisp, sharp shadows on a wall etc., coherent light is definitely the way to go.

Coherent light is efficient because the energy travels with little or no obstruction. If you are trying to light a background area with minimum wattage, a coherent light high and in-line with the camera may produce the most foot-candles.

Because coherent light is directional, intensity does seem to "fall-off" more quickly than with diffuse light. This characteristic can be used to dramatic effect by placing a coherent light fixture very close to the object or subject. The image will have a pronounced tonality shift even over a fair short distance.

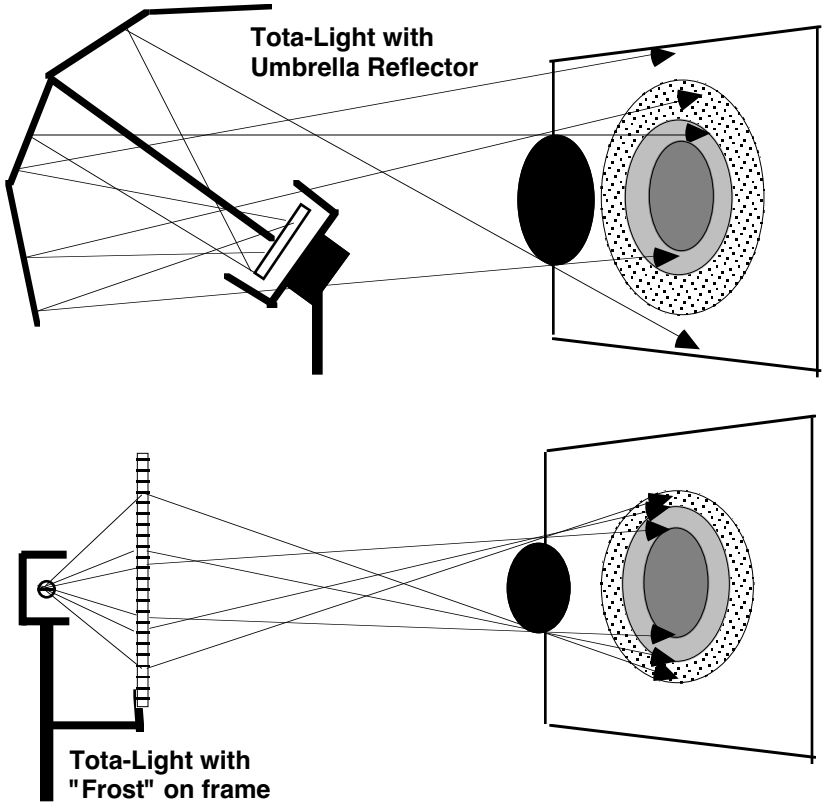
Drawbacks with coherent light should be apparent: scenes often have darker shadows and overall higher contrast producing a wider range of light intensities. Reproducing an interesting range of grays with coherent lighting is often more difficult. However, if coherent light is used to light a scene head-on, the image can look flat and shadowless.

Don't expect the wire scrims that come with many lighting kits to significantly alter the nature of coherent light. The harshness is more efficiently removed with thin spun fiberglass in front of the fixture on a special mounting frame. Here's a list of some common coherent and semi-coherent light sources:

Coherent	**Semi-Coherent**
Bright, Direct Sunlight	Sunlight through slight haze
500 & 750 Watt Tota-Light (Tube Kit)	Tota with spun glass
Common Household Clear Light bulb	Frosted Household Bulb
Lowel or Colortrans *Spot* Fixture	Spot with spun glass
Lowel or Colortrans *Broad* Fixture	Broad with spun glass
PAR Type Spot	Par Type Flood
Fresnel Spot (studio)	Fresnel with spun glass.

Diffuse Light

The other type, *diffuse* light is usually a source of coherent light that has been reflected or refracted--that is, bounced from an additional surface or directed through a translucent material like heavy spun glass or frosted plastic. As a result, the light rays arriving at the object come from many more angles and the shadows produced are much softer.



Creative Use of Diffuse Light

Flesh tones and middle values can be rendered with more subtlety and contour under diffuse lighting. As a rule, a wider range of range of grays is easier to produce but the fixture will have to be placed quite a bit closer to the subject to compensate for the reduction in intensity.

More flexibility in lighting angles exists with diffuse light. When using it as the primary light in a scene, experiment with side lighting more than you might normally. Adding a bit of coherent light from behind, above or from the other side can add depth and variation.

Here is a list of some common sources which produce diffuse or soft light:

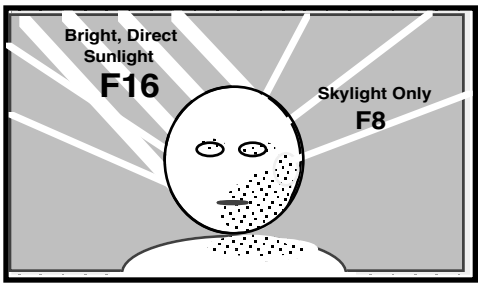
Sources of Diffuse Light

Skylight
Overcast Skies
Umbrella Fixtures
Fixtures with Frost
Fluorescent Lights
Broad or Spot lights "bounced" from showcards
Sunlight through translucent materials like vellum
Dusk and Dawn
Softlight Boxes
Broad and Spot lights through heavy spun glass

Controlling Contrast

As film stocks are sensitive only to a limited range of intensities, understanding how an object's appearance is affected by lighting requires studying variations of only the brightest sources.

In the light of day, primary sources include direct sunlight, skylight, light diffused through clouds and these sources reflected from nearby surfaces. The source responsible for the greatest amount of light is called the *key* light. Let's examine the lighting contrast of a familiar outdoor situation.



In the above example, the (coherent) light arriving directly from the sun provides the most illumination. The sun is functioning as the *key* source. The (diffuse) light coming from the sky is less bright and arrives from many angles. Because the secondary light (skylight in this example) is less bright and it tends to fill-in the shadow, its is also called the *fill* light.

The ratio of the intensity of the key light to the fill light is a matter of obsession with cinematographers. In the above daylight example, if one were to take a close-up light meter reading of the left side of the face only, the reading would be measuring the combined effect of the direct sunlight and the skylight. A close-up reading of the shaded side of the face would measure only the skylight. If the reading on the left is F16 and the reading on the right is F8, a difference of two stops

in light intensity exists. Each stop is actually a doubling of light, so the *perceived ratio* in measured units (electro-volts, foot candles etc.) would be 2 X 2 or 4.

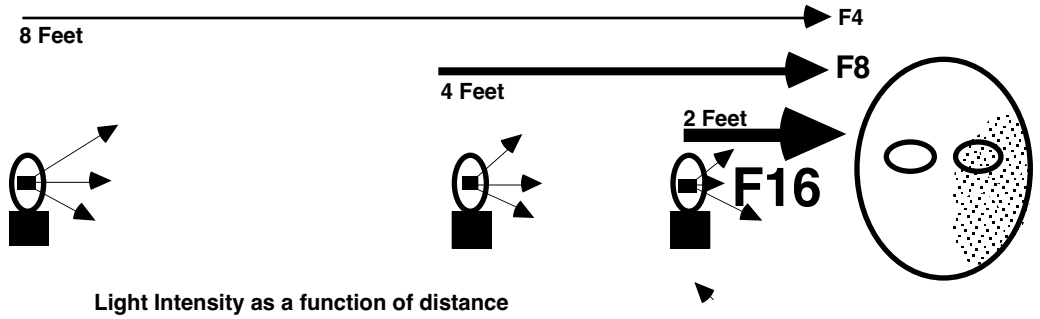
The astute Director of Cinematography would observe, however, that the *lighting ratio* of the light from the key source to the light of the fill source in this example is not quite 4:1. The left side of the face is being illuminated by *both* direct sunlight and skylight making the lighting ratio a little less than 4:1.

The effect of the *lighting ratio* on the film image has a lot to do with the exposure latitude of the film stock used. The visual effect of lighting ratio is often describes in terms of *contrast.* For Tri-X and Plus-X Reversal, these ratios and corresponding terms often apply:

Lighting Ratio:	Visually Descriptive Terms:
1:1	Very Low Contrast, "High-key", Bright
2:1	"Normal" Contrast, "TV Contrast"
3:1	Slightly Contrasty"
4:1	"Contrasty"
6:1	High Contrast, "Low-key," "Dark"
8:1	Very High Contrast, "Very Low-key"

With Plus-X or Tri-X, BDS lighting can be produce higher contrast images that obscure detail in the shadows. The 4:1 ratio can be lessened by positioning a fairly large flat or slightly curved matte white surface (white posterboard works) so that the direct sunlight "bounces" into the shadow area. A ration of about 2:1 in BDS is pretty easily achieved. (See Lenny Lipton page 218). In a similar application, a mirror can be used as a mini-spot.
One can also take advantage of the high lighting ratios outside by shooting into or out of shaded areas for special effect. Subjects exposed for normally in the deep shade will render the landscape under bright sunlight as white. Conversely, the subject under the tree would be in darkness when the landscape is normally exposed.

Indoors under artificial lighting, experimenting with lighting ratios is quite easy. Even with two lights, changing the distance from light to subject drastically changes its effective intensity. Each time you move the light to halve the distance between the light source and subject, the intensity increases a factor of 4:



Light Intensity as a function of distance

With artificial lighting it also easier to employ *moving light sources* during filming. Shadows come alive. If there's dark, deep space behind the subject, the shadows will disappear and the effect of moving light can be more subtle and psychologically complex.

The *directions* from which an object is lit can make it seem flatter or more dimensional. Head-on or *bash* lighting tends to flatten objects. Side or 3/4-lighting with careful fill lighting tends to make objets seem fuller. A third light, some times called a *back* light can help separate the object from the background by creating a thin, bright "highlight" or "rim" on the high-textured edges like clothing, hair etc.

Objects with lots of *surface texture* or translucence are also interesting to experiment with.

Location and Motivated Lighting

Realistic results with artificial lights on location are based on carefully studying locations of the type you imitating. Is there diffuse or coherent lighting? What are the lighting ratios? Sometimes the existing lighting is attractive but is simply not bright enough to shoot with. Other times, you may decide to start from scratch and create a new impression. In both cases, start with the key light. Here are some tips.

- If the existing key light(s) are appropriate but do not produce enough intensity, add higher wattage bulbs next to the existing fixture or replace the low wattage with 250 or 500 watt photo-floods. Watch-out for overheating! Next, look at the fill situation. Use bounce lighting, an umbrella light or frost .

- When starting from scratch whether on location or in the studio, imagine an appropriate lighting situation and re recreate it. Start with the key light: A window? A common light fixture? A streetlight? A candle? etc. Is the key light you are simulating coherent or diffuse? Use the brightest of the right type you have and position it realistically for your key. For fill, consider likely sources: reflections from walls, floors and tabletops, more distant light fixture or window light. Use a the right type of light and position it accurately. Note that lighting from low and side angles is fairly unusual. Detail lighting such as eye sockets or highlighting particular areas is the next step, but this requires pretty sophisticated mini-spot fixtures.

By motivating your key and fill lighting in this way, you'll be a lot more successful at creating a natural look.

Exposure Chart for Tri-X- Reversal

Test conducted Spring 1998

Bell & Howell 70 DR
24 FPS or 1/42 second

Lighting Fixture(s)	No. (Ratio)	Distance	Best Exposure
Tota-Light (Broad)	1 key only (5:1)	8'	F 5.6
Tota-Light (Broad) Tota-Light (Broad)	1 key 1 fill (3:1)	8' 16'	F 5.6
Tota-Light with Umbrella	1 key only (8:1)	6'	F 4.0
Tota-Light w/ Umbrella Tota-Light (Broad fill)	1 key 1 fill (4:1)	6' 20'	F 4.0
Tota-Light w/ Umbrella Tota-Light (Broad)	1 key 1 Rim (6:1)	6' 20'	F 4.0
300 Watt Frosted Bulb (bare bulb, no reflector)	1 key only (8:1)	5'	F 2.8
Flourescent Bulb	1 4' 40 watt tube as key	3'	F 2.4

Kodak 16mm B & W Camera & Print Stocks

KODAK PLUS-X Reversal Film 7265 (NEW)
A medium-speed, panchromatic black-and-white film suitable for general exterior photography. It has a high degree of sharpness, good contrast, and tonal gradation. It can also be used in interior photography with ample artificial illumination.

EXPOSURE INDEXES
Kodak recommended reversal processing:
Tungsten (3200K) - 80 Daylight – 100

No tests have been run on Plus-X as of 1/1.1/04, Its possible that the recommended ASA will be the same as "old" Plus X or,
Tungsten (3200K) - 40 Daylight – 50 ???
For negative processing:
Tungsten (3200K) - 20 Daylight - 25

EXPOSURE TABLE - TUNGSTEN LIGHT
This table is based on EI-80 (tungsten) and reversal processing with a shutter speed of approximately 1/50 second, 24 frames per second (fps), and 180-degreeshutter opening:

Lens Aperture	*f*/1.4	*f*/2	*f*/2.8	*f*/4	*f*/5.6	*f*/8
Footcandles Required	32	64	125	250	500	1000

KODAK TRI-X Reversal Film 7266 (NEW)
Reversal Film 7266 offers finer grain and increased sharpness, and includes EASTMAN KEYKODE Numbers for easy cross-reference of shots in minutes, not hours. Reduced static support allows for a cleaner image throughout the filmmaking process. And because our new films do not require processing in a bleach containing heavy metals, they are easier on the environment. Our improved films provide the rich blacks and high contrast you have come to expect from KODAK Black & White reversal films.

EXPOSURE INDEXES
Eastman Suggested: Tungsten (3200K) - 160 Daylight – 200

Film Department suggested as of 1/04

Tungsten (3200K) 60->80 Daylight 80->100
Use these indexes with incident- or reflected-light exposure meters and cameras marked for ISO or ASA speeds or exposure indexes. These indexes apply for meter readings of average subjects made from the camera position or for readings made from a gray card of 18-percent reflectance held close to and in front of the subject. For unusually light-or dark-colored subjects, decrease or increase the exposure indicated by the meter accordingly.

EXPOSURE TABLE - TUNGSTEN LIGHT
At 24 frames per second (fps), 170-degree shutter opening:

Lighting Contrast -
The recommended ratio of key-light-plus-fill-light to fill light is 2:1 or 3:1. However, you may use 4:1 or greater when a particular look is desired.

Lens Aperture	*f*/1.4	*f*/2	*f*/2.8	*f*/4	*f*/5.6	*f*/8

Footcandles Required	16	32	64	125	250	500

Eastman Reversal B &W Film 7361
A black and white reversal film intended for making prints from black and white and color reversal originals. Suitable for making work prints and can be processed in the same solutions as Plus X and Tri X Reversal. Exposure Index numbers are not given for print films as sensitivity may vary from emulsion batch to emulsion batch.

		perf	*Cat, No.*	*Net ea.*
RBW452	2X1200' On Core	2R-3000	162-6324	_____
RBW618	2X1200' On Core, A wind	1R-3000	190-5587	_____

Eastman High Contrast Positive Film 7362
An orthochromatic (blue sensitive), Black & white high contrast stock useful for making negative and positive titles and high contrast special effects. Process negative in D-11 or D-19. May be processed in reversal chemistry but with unusual results. Exposure Index numbers are not given for this film and sensitivity varies drastically under lighting types. Try EI = 12 in Daylight, EI = 3 in Tungsten.

		perf	*Cat, No.*	*Net ea.*
HCP451	400' On Core	2R-2992	173-6818	_____
HCP452	2X1200' On Core	2R-2994	162-6043	_____

Eastman Fine Grain Positive 7302
An orthochromatic (blue sensitive), black & white stock designed for making prints from black & white negative camera originals. Frequently used as white leader. Process negative in D-11 or D-19 or may be processed in reversal chemistry with unusual results. Exposure Index numbers are not given for this film and sensitivity varies drastically under lighting types. Try EI = 8 in Daylight, EI = 2 in Tungsten. Check on availability before ordering.

		perf	*Cat, No.*	*Net ea.*
FRP618	2X2000' On Core, A wind	1R-3000	175-2443	_____

Stocks longer Available from Kodak :

Eastman Plus-X Reversal Film 7276 (OLD)
A medium speed, reversal type panchromatic film suitable for general exterior cinematography in daylight or indoors where considerable artificial lighting is available.

EI = 40 Tungsten EI = 50 Daylight

Eastman Tri-X Reversal Film 7278 (OLD)
A high-speed reversal type panchromatic film suited for fairly bright available indoor lighting, artificial studio lighting and outdoors filming under most conditions except, bright, direct sunlight. (Tri-X can be used under bright direct sunlight with motion picture cameras such as the Bolex Reflex by using the variable shutter or a neutral density filter).
EI = 160 (Tungsten) This E.I. Subject to Testing EI = 200 (Daylight) This E.I. Subject to Testing

Students are eligible for a discount when ordered directly from Eastman Kodak.
Order forms are available in MIT B-70.

In Camera Special Effects – Bolex Rex

Single-Framing

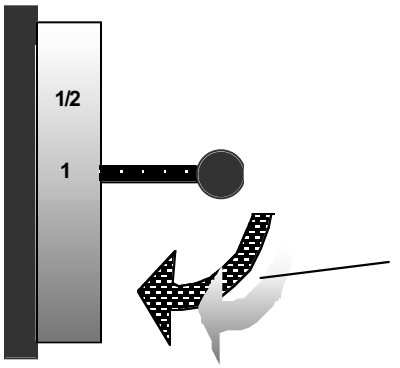
Two modes are available, "**I**" and "**T**." The **"I"** or ***Intermittent*** mode, takes one, brief exposure every time the button is pushed forward. An effective shutter speed of 1/40 sec can be used in determining exposure when the fps knob is set at 24fps. This would be the conventional mode to use when there is sufficient light and minimal motion blurring is desired. With the "**T**" mode selected, the shutter remains open for as long as the single frame button is pushed forward allowing one to make "***Time***" exposures allowing for low light levels and motion blur effects. A related special effect is to move the camera *itself* while making time exposures.

Staccato

When the fps setting is set to the minimum of 12fps, the camera has a lower acceleration—that is-- it comes up to full speed (12fps) at a slower rate than it would at 24fps. If you tap down very briefly on the "go" button, this will create a burst a few frames long with uneven exposures. If you produce a bunch of these short bursts back-to-back, it create a crude pixillation effect with motion speeded up about 4X to 8X normal speed. Estimate shutter speed at about 1/10 sec when the blasts are just a few frames long and the filming speed is set at 12fps.

Fades and Exposure Fluctuation

The variable shutter can be moved while the film is being exposed to create fade ins and outs. To create smoother fade, the motion must be slower at the lower part of the lever:



Most of the change in manual fades is produced at the lower end of the lever -- move the lever slowest in this range

Fluctuation in the density of the overall image can be created by moving or jiggling the variable shutter lever while shooting, With high contrast film stocks a powerful "sweeping" effect can result depending on the range covered by the variable shutter movements.

The variable shutter also provides another way to shorten the shutter speed:

variable shutter **open**			variable shutter at **1/2**		variable shutter at **1**	
	130°		65°		32-35°	
fps	real	**effective**	real	**effective**	real	**effective**
12	1/33	**1/40**	1/45	**1/55**	1/75	**1/94**
16	1/45	**1/55**	1/60	**1/75**	1/100	**1/125**
18	1/50	**1/60**	1/70	**1/87**	1/110	**1/137**
24	1/65	**1/80**	1/90	**1/112**	1/150	**1/163**
32	1/90	**1/110**	1/120	**1/150**	1/200	**1/225**
48	1/130	**1/160**	1/180	**1/225**	1/300	**1/375**
64	1/180	**1/220**	1/240	**1/300**	1/400	**1/500**

Multiple Exposures or Superimposition

Multiple Passes. You can make multiple exposures with a Bolex Rex same as you can with Bell & Howell 70 DR by running the film stock through the camera multiple times. You must use double-perforation film. To make a whole roll of double-exposed images, run the roll completely through first underexposing each shot 1 stop. Place the take-up spool, on the supply side and thread the film through the gate in the usual manner. When running the film through the camera the 2nd time, hold the camera held **up-side down** to make the 2nd pass images appear in the same up/down orientation as the first pass. If you want to "match-up" specific images to be superimposed, you'll have to keep careful notes of the images and elapsed footage when making the first pass. Note that time will also run backwards in the second pass. If you'd rather not hold the camera up-side down or produce with reversed motion, take the film to MIT B-42A and rewind it back onto the original camera spool *in the complete darkness.* See chart below for calculating exposures with multiple passes. Note that placing the variable shutter in the “1” position is sometimes easier than stopping down 1 stop on the lens.

Rewinding the Filmstock. This process allows you take make more precise time aligned superimpositions. The first exposure is made in the normal manner with F-Stop correction only and then a rewind key s used to back-up the film in the transport to be exposed again. The bolex rewind key is a separate checkout item in most kits. Here are all of the steps.

1. Make note of the feet and frames you are starting the shot at.
2. Underexpose the shot 1 stop for a double exposure.
3. At the end of the take, close the variable shutter
4. Disengage the drive motor.
5. Push the “go” button all the way back until it clicks on.
6. Put in the rewind crank and turn in direction of the arrow until the camera is located at the lead of the shot. (each revolution = 8 frames or 5 revolutions = 1 foot)
7. Push the “go” button forward.
8. Re-engage the Drive Motor (it should click all the way into the Motor position)
9. Underexpose the shot 1 stop for a double exposure.
10. Open the variable shutter
11. Take the second exposure

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Manual Cranking

The film can be hand cranked through the camera in either direction with the rewind crank when the knobs are set as described in step #7 above. Open the variable shutter before shoot. When the filming speed knob is set to 24 fps (the resistance changes with this setting), you should be able to turn the crank about 3 times a second to reach 24 fps. Of course, the advantage of hand cranking is giving the footage a rougher look—adding more variation in speed and exposure. With the variable shutter fully open, if you turn the crank one revolution per second, that would be 8 fps with an effective shutter speed of 1/25 sec. If you crank 1 revolution every 4 seconds, estimate 1/5 sec as an effective shutter speed.

Calculating Exposures for Superimpositions

The below simple F-Stop compensations can be used as you start to learn more about the subtleties making composite imagery.

Number of Superimposed Layers	Under-Expose Each Layer:\
2	1 STOP
3	1.5 STOPS
4	2 STOPS.
5-7	2.5 STOPS
8	3 STOPS

Tips about Composite Images

- If both or all of the shots to be combined have objects against a "black" background and the lighted objects will not over-la, little or no exposure adjustment needs to be made.

- Superimpositions often look more interesting when parts of the images merge into the illusion of one image rather than discernable “layers.” It can help if you allow textures and values from each of the exposures to dominate in different areas of the frame and not have both images “compete for the whole frame. Including “black” or dark gray areas in each exposure is one simple way to encourage this to happen even if you don’t keep track of all of the compositions you used.

- Use a tripod or make very slow camera movements if the camera is hand-held. Layers of jumpy images tend to make the images seem separate and the fact that two superimposed images are being used becomes obvious. Repetitious movements can also detract from the effect.

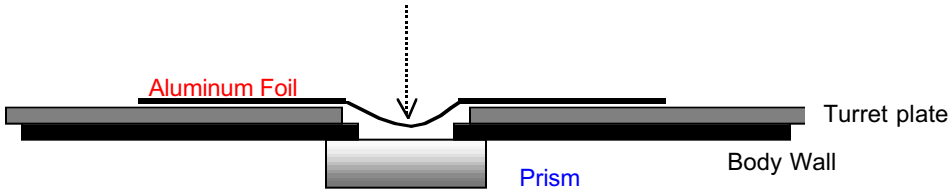
Pinhole Lenses. Those familiar with still photographic "pin hole" images might want to try this technique:

- Make a note of where the lenses on your turret arelocated.

- Remove all of the lenses from the turret and place them in a clean plastic bag for safe-keeping.

- Place a 4” X 4” sheet of aluminum foil centered over the middle lens opening of the turret.

- Slightly depress the foil into to the opening that would ne used by the “taking” lens until it *almost* touches the prism.



The further you press it in, the wider the angle your pinhole lens will have. If you push it in too far, tyou can scratch the prism and its VERY EXPENSIVE TO REPLACE.

- Taking care not to strike the prism, prick a small hole in the aluminum foil in the center of the opening with a sharp, sewing needle.

- Use black electrical tape to seal down the edges of the aluminum foil.

- With Tri-X-Reversal, you should be able to get good exposures in the neighborhood of 8-24 FPS under bright, direct sunlight. Every pinhole lens has a unique F-Stop number and each seems create slightly unique results. A "dreamy," soft look is common.

- The depth-of-field for a pinhole lens is infinite. Everything from the hole itself to deep space will be rendered with equal "focus." Try filming objects very close to the lens but don't block the sunlight.

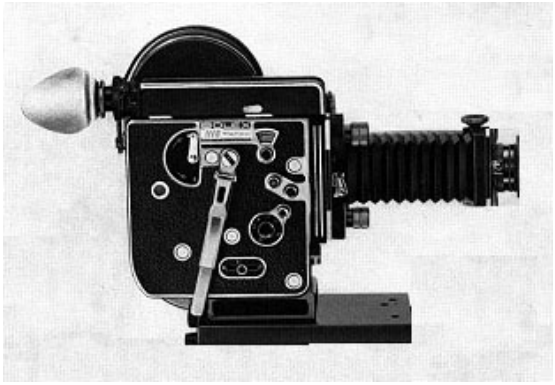
- Don't forget to return the lenses to their proper holes before you take the camera back to check-out.

Other Special Effects

The Bolex Rex is a very versatile camera to experiment with. You can make “mattes” for the filter holder with sheets of very of thin opaque and translucent materials. There is a set of Extension Tubes in check-out to permit cinematography on the scale of 1:1 or closer. You need special permission from the instructor to check these out.

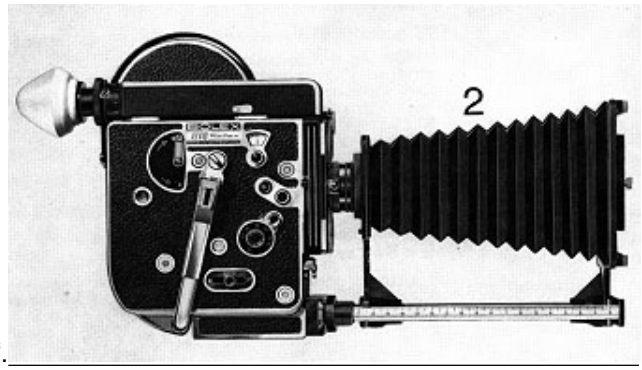
Adapting a bellows for close-up work

No extension tubes? Any way of supporting the lens away from the body will allow small scale cinematography. If you work in a darkened room the bellows in not crucial. Exposures cannot be computed as usual. Best to run tests and open up many stops and/or slow down exposures



Matte Box

We don't have a matte box for the Bolex but you can get a sense of a basic design from the below picture. The box creates a shaded plane in front of the camera in which many materials can be inserted or to "matte" or black out parts of the frame area for composite imagery. A window in a darkened room is one substitute for a matte box.



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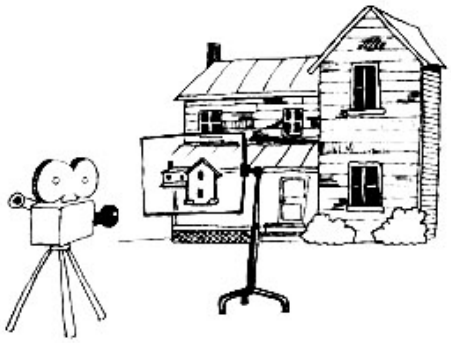
Glass Shots

Glass shots" are another special effect with many possibilities to explore-- especially with the ability to print out imagery onto clear acetate from a computer.



from davenportfilms.com

Soundtrack Production

Stages and Techniques

Just as one determines locations, subjects, camera positions, lens settings and lighting when creating interesting images, one must learn to recognize and tailor the qualities of sound to make making an interesting soundtrack. In bringing your film soundtrack to a final “mixed” state this semester, there are six stages of sound production.

Good soundtracks have intriguing qqualities which attract and engage the listener's curiosity. Some key characteristics are:

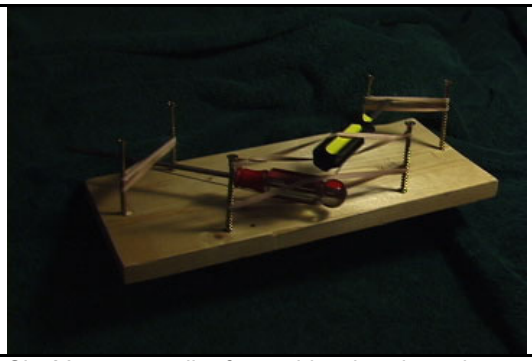
- **Rhythms performed or created from a variety of sound sources to establish and alter expectation .**
- **Full Tonal Range-- a mix of elements with frequencies from very low (80 Hz) to high (8,000 Hz).**
- **Spatiality-- a mix with both sustained and percussive sounds to create an illusion of space.**
- **Change and development by creating differing "movements" in the final composition-- not just a single mood.**

The best way to learn to notice interesting sounds and ways to make interesting recordings from them is to get out make some recordings to evaluate.

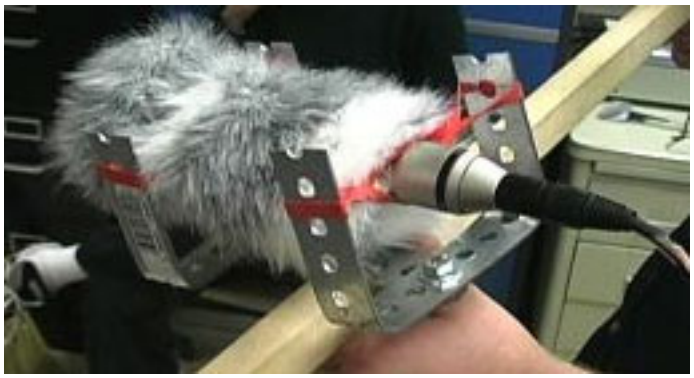
1. Preparing your Gear

- Use high quality, high-bias or better yet, Type IV metal tape. Check the switches under the cassette lid of the TC-D5M to make sure the tape type selector switch is set correctly for the tape you are using. Recordings on “Normal” tapes will have more hiss.

- Use only alkaline batteries for the recorder and the Rode NT-3 and professional lav mics (D- size, 9 volt and AAA respectively), To check the state of the battery on the TC-D5M, press play and Bat Check. The needle should come up to the green rectangle on the VU meter. The red light on the Rode NT-3 blinks red for just a moment when you turn it on to indicate it has adequate power output. A set of two AAA’s for the Sound Professional Lavalieres will last all semester if you take them out when not being used.
- Use the provided, fully-enclosed headphones while you are recording. Use them for carefully monitoring what you are recording but also to detect buzzes and hums associated with bad connectors and cables.
- Its nearly impossible to hand-hold a sensitive mic like the Rode NT-3 without getting “bumps” and a range of rustling and rubbing sounds from direct mechanical transfer through the body of the mic. Its pretty easy to construct your own microphone “shock mount” using rubber bands and a variety of materials to make two hoop, or brackets or a tube skeleton to suspend the mic within. Here are some designs to get ideas from.

This one used two hoops of hand wrapped heavy wire and two rubber bands	Heavy cardboard tubing is strong enough to hold a Rode NT-3 . Optional small bungee cables are used here instead of rubber bands.
	
Aluminum brackets, bolts, nuts, two rubber bands and a foam handle	Six 20 penny nails, four rubber bands and a small board are used for this X-Y stereo shockmount.

- To prevent the wind form causing distortion, use fake fur and safety pins to fashion a loose zeppelin or shock to slide around the head of the mic before installing it into the shock mount. You can buy fake fur in fabric stores and in small rolls in Walmart.



3. Tracking Sounds and Micing them in the Field.

- At any given time in any location, there are interesting sounds to discover and try recording. Before you start recording, walk around the location and determine what the main sounders are.

In urban locations some typical ones are: traffic, compressor and motor rumbles, fans, transformer hums, HVAC duct rumbling, appliance and lighting buzzing and the drones of factories or construction in the distance. As you walk around, keep an ear open for higher frequency sounds—those with percussive qualities like taps, tinks, scrapes, squeaks, pops, squeals. You can also thump or wiggle or vibrate materials to create sounds.

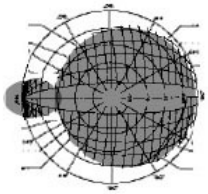
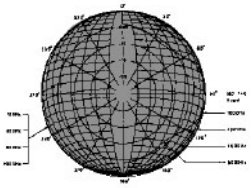
- To create sense of depth or space in a monaural soundtrack it takes a mix of three elements. Each of these is recorded separately in the field:

    A. Foreground Sounds: Louder sounds that seem close.

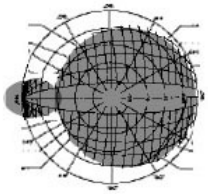
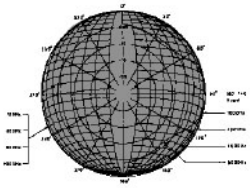
    B. Background Sounds: Soft sounds that seem far away.

    C. Middle-Ground sounds: Soft to medium loud details from the immediate area.

- **Recording Background Sounds.** Background tracks might be the hardest to find and record. They provide the context for the other sounds in the scene and they and they do this important work inconspicuously. When scouting for a spot from which to mic a location, try to get away from the main sounders into an open area where the sounds from many source converge. Dominant Qualities: *Background sounds in rural settings are low in tone and sustained in duration. In remote, rural settings, they can be a mix of percussive middle ground effects coming from a distance. Such sites are increasingly rare.* For Background Sounds, the record level should be set so the peaks extend no higher than –5dB on the Vu meter. Sometimes, as with quiet interiors, the sound will only be loud enough to cause the record meter to barely move even with the record level at full gain.

	Background Recording	
Microphone Rode NT-3; Polar Pattern: Unidirectional; Noise Low; Sensitivity: High.,	Applicability	Technique Tip/ Best case scenario
Rode NT-3 Unidirectional Noise: Low Sensitivity: High 	Rejects sound from the sides and favoring what is directly in front of the mic. Make you point the mic in the direction that creates the blend of sounds you are after. Probably not the best mic to use for recording background ambience in louder settings	Use a shock mount and zeppelin. Very sensitive to wind interference. Because of its low noise, the Rode NT-3 will work better than the other mics for recording location ambience in very quiet locations such as in remote areas or quiet interior locations.
Sound Professional Lavaliere Omnidirectional Noise: High Sensitivity:High 	The omnidirectional pattern can lend more spatiality to background recordings and the high noise level will not create major problems in many urban settings. It is, however not suitable for recording location ambience in very quiet settings like minimal interiors and rural settings.	Up in the air away from other surfaces will give a more open sound. To protect from wind, place the head inside a small roll of fake fur.
Radio Shack PZM Hemispherical Noise: High Sensitivity: Low 	Can provide more lower mid range clarity in loud settings than the Sound Professional Lavaliere. Its high noise and low sensitivity make it a poor performer for recording in very quiet settings like minimal interiors and rural settings.	The design of the mic element makes it very effective at rejecting wind noise. Works best when placed on the ground. Will pick-up less bass if placed on a a flat area less than 18” X 18”.

- Recording Foreground Sounds. You can tell when you have located a sound with foreground potential because it has a variety of tones and rhythmic variation. Unfortunately, they are kind of rare. The most common foreground soundtrack element is voice, The human voice produces both deep tones and high pitched consonants. It is capable of lots of rhythmic variation and nuance in delivery and rhythm. Some musical instruments do as well. One can come across some very good foreground sources striking, rubbing and jiggling various small and large objects one comes across in the field. Dominant Qualities: Variation in tone from low to high and with rhythmic variation as well. For Foreground Sounds, set record level on the VU meter so the peaks reach no further than –5 to –3dB.

	Foreground Recording	
Microphone Rode NT-3; Polar Pattern: Unidirectional; Noise Low; Sensitivity: High.,	Applicability	Technique Tip/ Best case scenario
Rode NT-3 Unidirectional Noise: Low Sensitivity: High 	Probably the best all around mic for foreground element recording because of its polar pattern can help separate a sound from the background. Always close-mic foreground elements when you can. When recording voice, place the mic on a mic stand and above the breath path about 6”-9” away. Do not try to hand hold this mic when recording voice.	Use a shock mount and a zeppelin when recording outdoors. This mic has a robust sound that gives foreground sounds edge and bite.
Sound Professional Lavaliere Omnidirectional Noise: High Sensitivity:High 	By far the best mic for recording interviews, not so much because of the sound quality but because a lavaliere can be clipped on the subject about 9” from the mouth and remain in place for a long time without creating volume changes and mic handling issues.	These lavs are so small they can be placed inside of toys, bird nests—you name it – to turn minuscule events into major ones.
Radio Shack PZM Hemispherical Noise: High Sensitivity: Low 	Not a good choice for recording foreground sound elements due to its poor ability to isolate sounds from the background.	The PZM plate will transmit sounds directly through its metal body so its possible to clamp this mic directly onto a vibrating object with a rubber tipped spring clamp or anything that will not dent or mark the plate.

- Recording Middle-Ground Sounds. If you go on a quest to discover interesting sounds and record a good variety of them, chances arethe majority of them will fit best into the middle-ground plane. They are more like classic “sound effects” in that they are typically higher in pitch and short in duration, In some cases they are perceived as “textures”— like trickling water, buzzing ciccadia or a whining light fixture—but these extended passages are actually densely packed percussive events. Dominant Qualities: High in tone and short in duration. For Recording Middle-Ground Sounds, set record level on the VU meter so the peaks reach no further than –10 dB. If the red “peak” light blinks steadily, turn the record level down until it blinks only occasionally.
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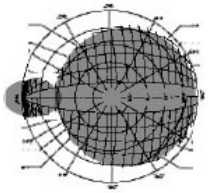
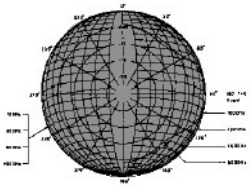
	Middle-Ground Recording	
Microphone Rode NT-3; Polar Pattern: Unidirectional; Noise Low; Sensitivity: High.,	Applicability	Technique Tip/ Best case scenario
Rode NT-3 Unidirectional Noise: Low Sensitivity: High 	Same micing as foreground sound applies-- close-mic whenever you can to give the sound as much separation from the background as possible. When “playing” surfaces and objects in the field, try softly striking or thumping at different spots and experimenting with mic location. Different micing positions can reveal a variety of sounds being produced.	Use a shock mount and a zeppelin when recording outdoors. This mic has a robust sound that gives foreground sounds edge and bite.
Sound Professional Lavaliere Omnidirectional Noise: High Sensitivity:High 	If the sounds are very quiet, favor the Rode because for less noise. If the sounds are fairly loud, you can use the Sound Professional and the suggestions above.	Excellent for capturing sounds inside of “containers” where a mic would not otherwise fit.
Radio Shack PZM Hemispherical Noise: High Sensitivity: Low 	Not a good choice for recording middle ground elements due to its inability to isolate sounds from the background.	Mostly drawbacks due to its inability to isolate sounds from the background.

More Field Recording Suggestions

- When recording a location or a background, move away from areas where sustained, low pitched sounds like motors, hums and traffic dominate. Move your micing position towards sounds that are higher in pitch and percussive if available. The low energy sounds are more powerful and will be adequately recorded even from a distance.

- When a sound source dominates a location, spend some time close micing it. Sometimes you will be able to obtain high pitched sounds and textures that are inaudible at a distance.

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- Locations change in character over time; make long recordings. For background tracks, record at least 15 minutes in each mic position and record at least two mic positions in each location. Even recordings of 30 minutes or an hour are often very productive. For middle ground and foreground elements, several 20+ second passages of each element will usually provide sufficient material and save a lot of time manipulating the tape when equalizing etc.

- Carefully label every cassette and remove the safety tab following each recording session when your memory of it fresh. Make your notes on the cassette itself that will be usefully descriptive years later. Dates and places can often tell you more than words describing the sounds themselves. You can also voice slate details on the tape. and

3. Mag Sound Transfers

This is the stage when selections from your cassette field recordings are played-back and re-recorded or "transferred" to 16mm magnetic film, or "Mag" film. Once on Mag film, the sounds can be edited, in sync with picture on a Steenbeck flatbed editor. Care is given in selecting your passages, adjusting their tone with equalization and making sure the record levels to Mag Film are correct and consistent. There are step by step instructions for this stage in the manual.

4. Sound Editing

This is the stage when three, magnetic film "tracks" are created on the flatbed editing table. Mag Track #1 contains Foreground Sounds. Mag Track #2 contains Middle-Ground Sounds and Mag Track #3 has the Background Sounds. The tracks are edited separately and in-sync with the film image. Usually the background track is cut in first and then foreground and middle ground. At the end of picture editing, there will be four rolls: one picture and three Mag Tracks all containing sound to create one demension of the the soundtrack space.

5. Digital Sound Mixing

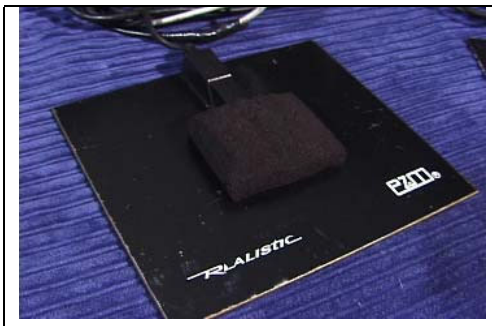
Next, the three Mag sound tracks are captured, one at a time to create three digital sound files. The files are loaded into an audio mixing software, LOGIC, where playback volume of each track can be carefully adjusted towards your final “Mix.” Additional equalization and mastering can also be done. A final monaural digital mix is made.

6. Transfer Mix to Mag Film & Sync for Double Projection

In order to project the film in double-system with sync sound, the sound must be placed back onto 16mm Mag Film. To do this, the digital sound Mix is played back on the computer and recorded with the original sync beep tone(s) onto 16m Mag Film. The Mag film with mix and the picture are taken to the Steenbeck and beep frames aligned and rolls synchronized. Now the film can be looked at with sync sound in B-65. Be sure to save all three of your Mag tracks in case you want to work more on your film at a later date.

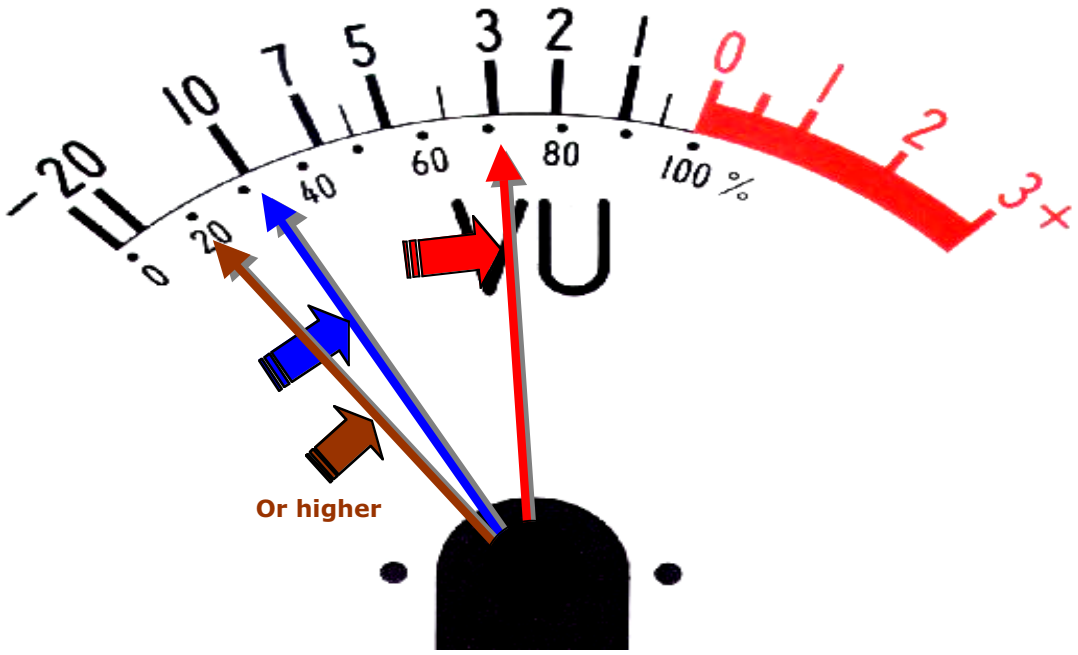
Sound Gear Check-List

		Sony TC-D5M Cassette Recorder **Power:** 2-D size batteries; High Bias or Metal Type IV cassette tape. **Disasters:** Turn **"-**20dB pad" OFF; Limiter Switch = OFF; Dolby ON; Will run on Low Batteries and make speed flawed recording. **Tech:** Mic Inputs" 2-1/4" Phone Plugs; Line Inputs: RCA phono (-10dB unbalanced)	
		Rode NT-3 Condenser Microphone **Power:** 1- standard 9 volt size battery. Unscrew body to carefully install. **Disasters: Very Sensitive to hand holding and wind noise. Make and use shock-mount and zeppelin outdoors.** Adequate Power from battery will cause the red light to turn on briefly when first powered. Inadequate power indicated by red light that stays on. **Tech:** Unidirectional Polar Pattern (objects directly in front will be louder than sides).	
		SP-LAV-1 Sound Professionals Mono Lavaliere Mic **Power:** Requires Sound Professional Battery Module below w/ TC-D5M. (Direct to camcorders) **Disasters:** Very Sensitive to hand-holding and wind noise. Use a **fake fur zeppelin** outdoors. **Tech:** Omnidirectional Polar Pattern, Can be used to record ambience as well as delicate effects in tight spots.	
		Sound Professional AN Battery Module **Power:** Requires 2 –AAA batteries **Disasters:** The 1/8" mini plug connections are less than perfect. Always monitor with headphones. **Requires a 1/8" female to 1/4" Male Phone Plug Adapter to work with the Sony TC-D5M Recorder. Use the input with the mic symbol on it (not the speaker).** **Tech:** The best quality lavaliere mic in checkout -- all Sony Lavs included.	

		**Radio Shack PZM Microphone** **Power:** Requires 1 AA battery. **Disasters:** Available with 1/4” phone plugs in checkout. **Tech**: Very resistant to wind, but sensitive to mechanical contact. For best performance place on flat area at least 4’ X 4’ . Best for location ambience but low sensitivity and noise makes it a lesser choice than the Sound Professional Lavs for this purpose.		

Field Recording Vu Metering Suggestions

Foreground Sources		**Voice and other sources with a mixture of percussive and sustained sounds.**	**- 3 peaks**
Middle-Ground Sources		**Short duration, high frequency “effects”**	**-10 peaks**
Background Sources		**Long duration, often low frequency dominant tones**	**-20 or Higher peaks**



VU meters, like the one on the Sony TC-D5M Recorder, are designed to have a relatively slow (delayed) response. For this reason, when recording sources with short duration content in the field, compensation is required.

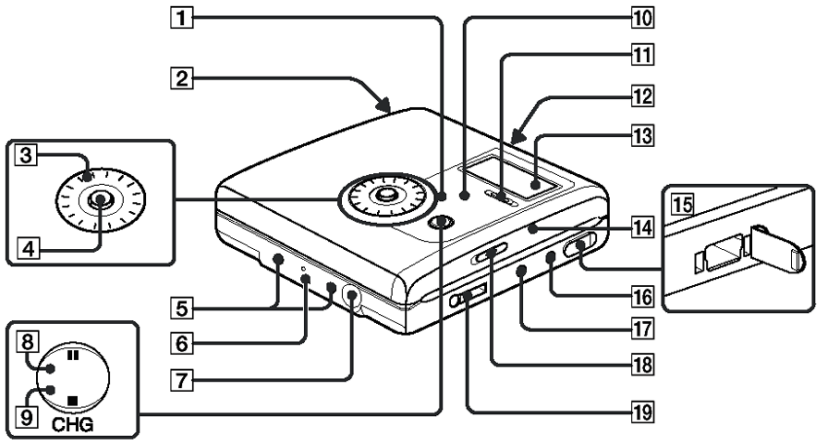
Recording with the Sony MZ-NH900 Hi-MD Recorder

The HiMD recorders can record in two formats: the higher-quality HiMD format or the Standard MD SP format. They can also record on both the old, "MD" discs and the new HiMD discs.

Until Sony produces the necessary software update and we have a PC transfer platform set-up for USB transfers, make sure the recorder is set in **MD SP Disc mode, NOT Hi-MD !!**

Set-Up Steps for the Sony MZ-NH900 MD Recorder

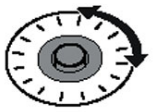
It is very important to go through these steps every time before you start recording and, preferably, before you set off to your location. Take some time to practice placing the recorder into manual record gain mode because you'll need to be able to do this quickly and confidently in the field. If you fail to do some of the below steps, your recording can suffer in terms of quality and in some cases, it may not be able to be digitally imported into a computer.



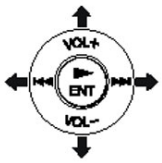
1 •NAVI/ MENU button
Press lightly to go to the NAVI (navigation) setting mode (page 48).
Press for 2 seconds or more to go to MENU setting mode (page 27).

2 Battery compartment

3 Jog dial



4 5-way control key



Operation	Function
Press ENT [1]	play, enter

Operation	Function
Press towards ⏮	find the beginning of the previous track, rewind
Press towards ⏭	find the beginning of the next track, fast forward
Press towards VOL +[1] or VOL –.	volume

[1] There are tactile dots beside the ENT and VOL + buttons.

5 Terminals for attaching dry battery case

6 Terminal for attaching the battery charging stand

7 DC IN 3V jack

8 ⏸ (pause) button

9 ■ (stop) • CANCEL/CHG button

10 GROUP button

11 ●REC (record) switch

12 OPEN switch

13 Display window

14 T MARK button

15 USB cable connecting jack

16 LINE IN (OPT) jack

17 MIC (PLUG IN POWER) jack
There is a tactile dot beside the MIC (PLUG IN POWER) jack.

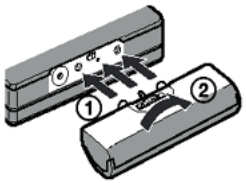
18 HOLD switch
Slide the switch in the direction of the arrow to disable the buttons on the recorder. To prevent the buttons from being accidentally operated when you carry the recorder, use this function.

19 🎧 (headphones/earphones)/LINE OUT jack

Perform these steps with No Disc in the Recorder:

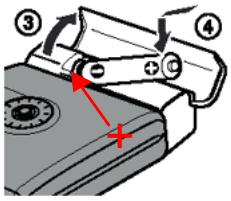
1 Attach the dry battery case to the recorder.

Rear of the recorder



Insert a LR6 (size AA) alkaline dry battery.

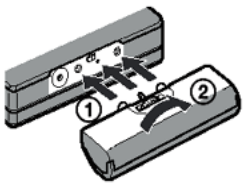
2 Insert the battery minus end first.



Perform these steps with No Disc in the Recorder:

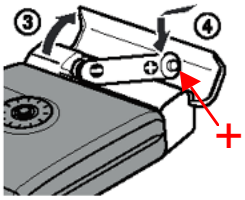
1 Attach the dry battery case to the recorder.

Rear of the recorder

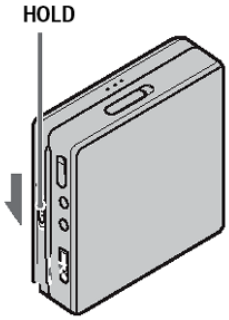


Insert a LR6 (size AA) alkaline dry battery.

2 Insert the battery minus end first.



3. Slide HOLD to the opposite direction of the arrow (→) on the recorder or the remote control to unlock the controls.

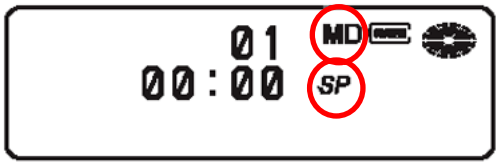


4. **Set to Advanced Menu Mode** Press and hold the Navi/Menu button for 2 seconds until the menu window activates. If "Menu Mode" is blinking, select it with the ENTER button (middle of Jog Wheel) and then select ADVANCED mode. Menu Mode is also available under the Option menu. You cannot access manual record level unless the menu is set in Advanced Mode.

5. **Set Disc Mode to MD - use this mode until Sony upgrades software.** Press and hold the Navi/Menu button for two seconds until the menu window activates. Rotate Jog Wheel until "OPTION" is blinking and select it with ENTER. Use Jog Wheel until "Disc Mode" is blinking, select it with ENTER. Jog to "MD" and select it with Enter

6. **Set Record Mode to SP** Press and hold the Navi/Menu button for 2 seconds until the menu window activates. Rotate Jog Wheel until "REC Set" is blinking and press Enter. Select "Rec Mode" and then "SP."

8. Look at the Menu window. The Record Mode should show "MD" and "SP. If the window shows HiMD or LP2, re-do the above steps 5 and 6.

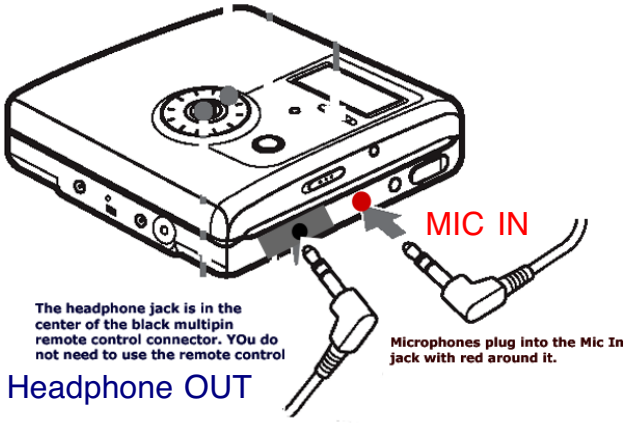


9. Install a fresh, alkaline, 9 volt battery into the Rode NT-4 mic by un-screwing the lower section of the body and sliding the battery into the cavity (terminals first). Check for correct polarity (+ to + and – to –). Secure the battery in place with the flexible spring clip and screw the sections back together.

10. Slip the mic back into the shock mount and attach the fake fur jacket. The Rode NT-4 mic is *very sensitive* to hand-holding and the slightest amount of wind. Unless you are mounting it on a mic stand indoors, the results are likely to be disappointing without a shock mount/zepplin. If your mic doesn't not have a shockmount/zepplin, consider making one yourself. You can find some excellent plans on the web including here: http://www.murdermedia.com/?p=goodies_shock_mount.

11. Its best to turn ON the mic before plugging it in to the Recorder. The switch is on the Mic body ON. When the NT4 is switched ON, the red battery status light should illuminate for about 1 second and turn off. If the L.E.D. remains illuminated significantly longer, the battery should be replaced. Life expectancy for a high quality alkaline battery is in excess of 400 hours. If left ON, the battery power will be unnecessarily depleted.

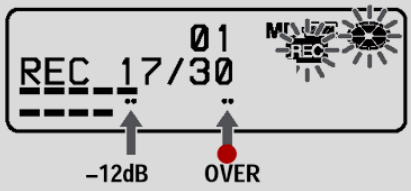
12. Attach the XLR-> 1/8" stereo mini-plug cable to the end of the NT4 mic. Plug the mini-plug connector into the RED mic in jack on the Sony Recorder and the headphones into the black headphone jack.


MIC IN
The headphone jack is in the center of the black multipin remote control connector. YOu do not need to use the remote control
Headphone OUT
Microphones plug into the Mic In jack with red around it.

13. **Set/Check Mic Sensitivity** (Low or HI) Press and hold the Navi/Menu button for 2 seconds until the menu window activates. Use Jog Wheel to navigate to "Rec Set" and then "Mic Sens." Select "High" if you are recording ambience or "Low" if you are recording close voice or loud sound effects.

14. **Set in Manual Record Level Mode** Unfortunately, one cannot go directly into Manual Record Mode; you must go into Auto Gain mode, place it in pause and then use the menu to change to Manual Record level. Push the RED REC button down and slide the button to the right to put the recorder in instant record mode (auto gain). Press on the PAUSE BUTTON. Press and hold the Navi/Menu button for 2 seconds until the menu window activates. Rotate jog wheel until "REC Set" is blinking. Select "REC Volume," and then "Manual." You can now adjust Record Level manually with the Jog Wheel. Set the record level gain so the normal volume "peaks" cause about 1/2 of the segments to come on (turn black). Notice that the over-modulation segment occurs right under the "0" of "30."

Set the level so that the meter segments light up around –12dB segment. If a high sound level causes the level meter to reach the OVER segment, lower the recording level. Each level meter shows the following.
Upper — L channel input level
Lower — R channel input level



You can change the record level as the deck while recording if necessary.

15. To start recording, press again on the Pause button. When you are ready to stop recording, press on the PAUSE button again. Try to not stop the recorder with the STOP button unless you are taking a break because this will take the deck out of Manual Record Level mode. Note that the recorder jumps to unused disc space when a new recording is started. Recordings are organized into "groups." A 'Group" includes all the tracks made with the pause button. Pressing STOP will cause a new "group" to be created the next time the a recording is made on the disc.

16. To raise the headphone volume, press on the top edge of the ENTER button and on the lower edge to lower the headphone volume. This may take some practice.

17. You can create a marker for a new track as the Recorder is running by pressing the "T mark" button above the mic input jack. This will create a new track at this point making it much easier to locate later.

18. **Allow the Record to Save the Files**. After pressing STOP, the recorder needs to write the file to the disk in order to save it. DO NOT remove the disk or turn off the power to the unit by removing the battery or power cord during this phase or you will lose the recordings on the disc.

19. Playing Recordings. Insert the disc, press the left or right edge of the ENTER button to shuffle through your tracks.

20. Prevent accidental erasure of recorded discs by sliding the white tab on the rear edge of the disc until the slot is open.

21. Disc Capacities: A standard MD disk has a capacity of 74-80 minutes recorded in SP mode. (Don't record in the LP mode, the quality is compromised!) A regular MD that is formatted in the HiMD mode has a capacity of 28 minutes in Linear PCM mode (non-compressed 16bit). The HiMD 1GB disks have a capacity of 94 minutes for Linear PCM mode.

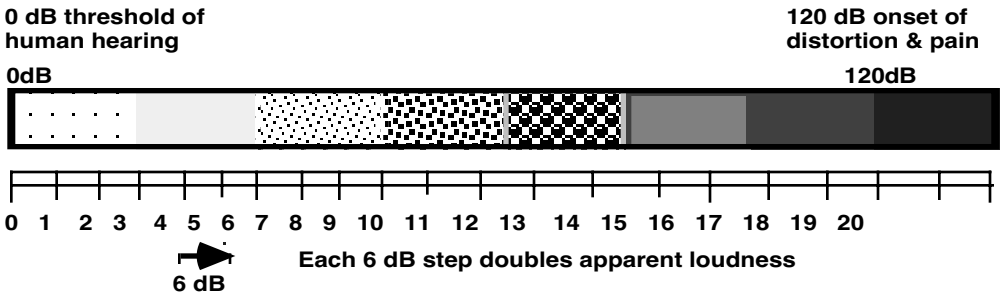
Key Sound Terms and Definitions

Loudness

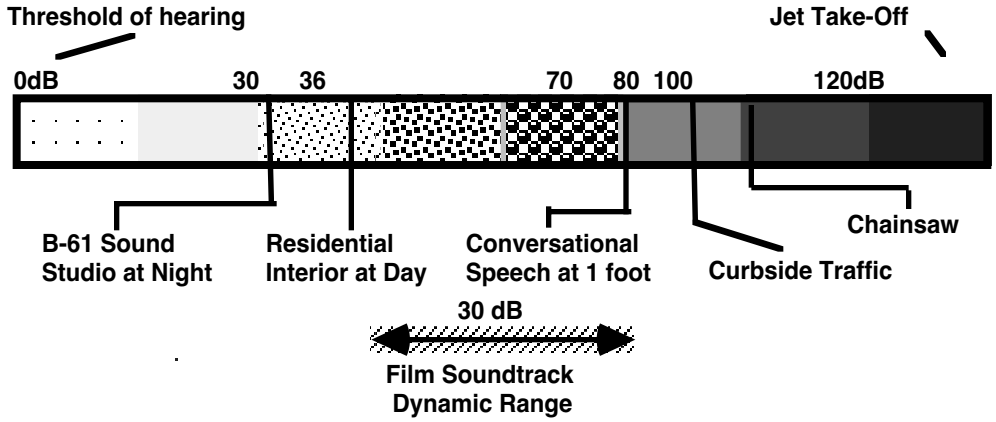
With many sounds arriving at the ears at once, a top priority of the "mind's ear" is to discern degrees of loudness. Typically one or two sounds seem loud and close, others are in general vicinity while many seem to arrive from much greater distance. The ear can detect sounds from all angles and from many distances but the brain attends to only one or two at a time.

The quality of “loudness” plays such an important role in listening that two sources with similar level tend to create confusion. To create a sense of depth or “space” in a soundtrack requires careful control, of the relative volume or the loudness of each of the sound elements in the mix. The final soundtrack emerges from only one spot in space with no other coding other than differences in volume to represent space.

Sound engineers use *decibels* (dB) to quantify the levels of sound energy detectable by the human ear. The scale is logarithmic with each increase 6 dB seeming to double the apparent loudness of a sound. A 6dB steps is kind of an audio equivalent of a F- STOP. 0dB is defined as the threshold of hearing and 120dB is regarded as the point at which many people begin to experience pain. This range from 0-120dB could be understood as an effective "latitude" in human hearing-- about 20 Stops.


0 dB threshold of human hearing
120 dB onset of distortion & pain
0dB
120dB
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
6 dB
Each 6 dB step doubles apparent loudness

Unfortunately, though understandably, sound media are not able to capture nor reproduce such a wide range of sound levels. The most expensive recording equipment can capture a range of about 90dB and the best theatres can represent a range of about 60dB. The 16mm optical soundtrack is capable of a range of only 30dB. This range of discernable levels is the *dynamic range* of a medium or system.

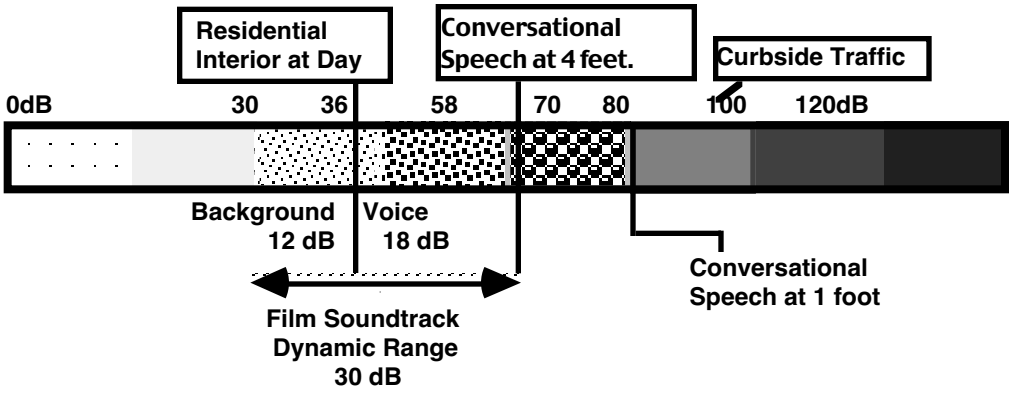


In a typical, urban, living room, one can hear a constant rumble that penetrates the window panes and walls. Whether it be from street traffic, factories and freeways or even the whir of ones’ own heating system, there is always a minimal level or "presence" in a setting. The perceived loudness or quietude of that level depends a bit on expectation and conditioning. A level of 40 decibels in one’s

living room seems much quieter than 60dB of hubbub from local street traffic in the backyard, but even the “quiet” living room is 50 times louder than the faintest sound level one can detect.

The high background sound levels of urban environments makes it harder for us to discern and record sounds. It’s common to hear students complain about the “bad sound” they got on a location shoot. Was the recordist conditioned to the background levels and not perceiving them as loud? An demonstration of relative volumes shows why bad sound easily happens.

A person speaking in a conversational tone at a distance of 1 foot produces about 70 dB of energy. If the room has a background level of 40dB, this is a separation of about 30 dB. Therefore if the mic is set-up at a distance of one foot from the person, the voice should record at 30 dB louder than the background—sufficient separation to be used in post-production. But if the mic is moved to 4’, the relative sound level of the voice drops to 58dB—and the voice will only be 18dB louder than the background sound in the recording. 30dB separation between voice and background sounds allows the sound editor to add background sounds of their choice. But with only 18dB of separation, the editor has no choice but to use the existing background sounds in the recording in the final mix.



As a guide in the field, the background sound level should not produce Vu needle movement on the Sony TC-D5M when the desired foreground sound level produces peaks to –5 to –3dB. If the needle is moving just from the background sounds, you need to move the mic closer.

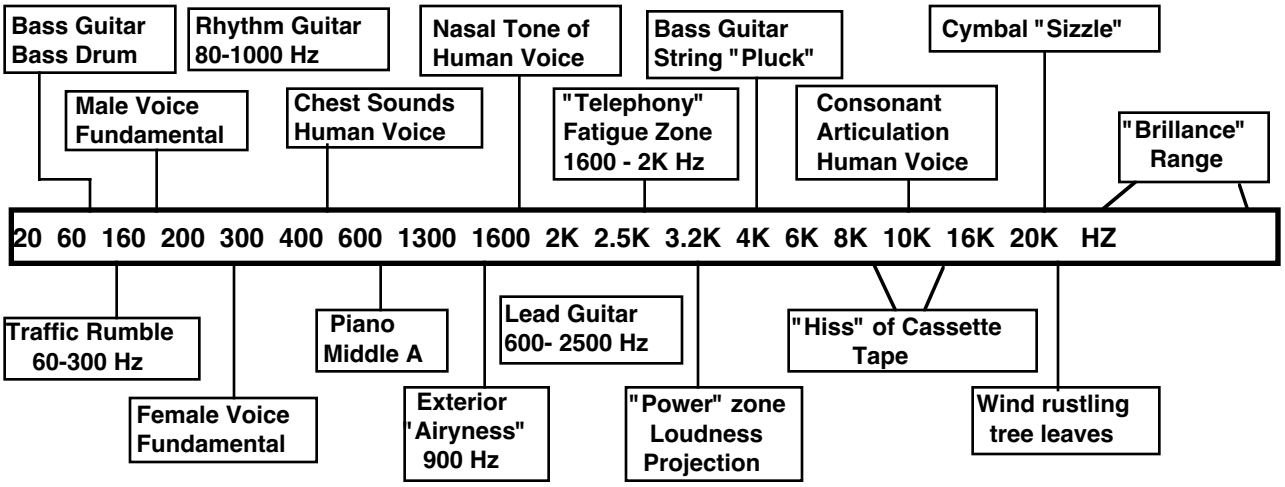
Pitch

Everyone is familiar with the tonal qualities of sounds produced by musical instruments and the pleasure of hearing a variety of tonalities within rhythmic patterns. The vibration rates produced by a bass guitar and a bass drum are relatively low whereas the pitches of the lead guitar and the saxophone are noticeably higher. If you listen carefully, you might discern that the rhythm guitar and the vocals have pronounced pitch qualities somewhere in between. Tonal variety is one characteristic that gives music great appeal.

Audio engineers measure the pitch by counting the vibrations occurring over a given unit of time. The more vibrations produced, the higher the pitch is to the ear. The term, *Hz* , is an abbreviation of

Hertz , the person who refined the study of sound vibrations in time. Hertz used the term *frequency* to describe the phenomenon of certain rates being sustained long enough to be discerned as pitch. As vibrations actually cause the air molecules to constantly move back and forth, the energy of sound is constantly changing direction or polarity. This wave-like or cycling nature of sound is reflected in another term used to describe pitch, *cycles per second,* or *CPS.* (*Hz* is a modernized form of *CPS.)*

Through testing, it can also be determined that human ears are able detect sound vibrations with frequencies from 20 cycles per second (or Hz) to 20,000 Hz. Although most sounds have several pitches occurring at once, the lowest frequency of a sound, is called its *fundamental.* As the fundamental frequency is usually the loudest frequency produced, charting the fundamental frequencies of common sound sources is one way to sense where certain sources cluster their frequencies within the range of discernible to humans. Such a chart is called an *Audio Frequency Spectrum.*



If a film soundtrack combines sound elements whose frequencies come from several different regions of the spectrum, it will have aural vitality. Soundtracks lacking clarity often have sound elements whose frequencies overlap and "mask" or fail to utilize an entire region of the frequency spectrum.

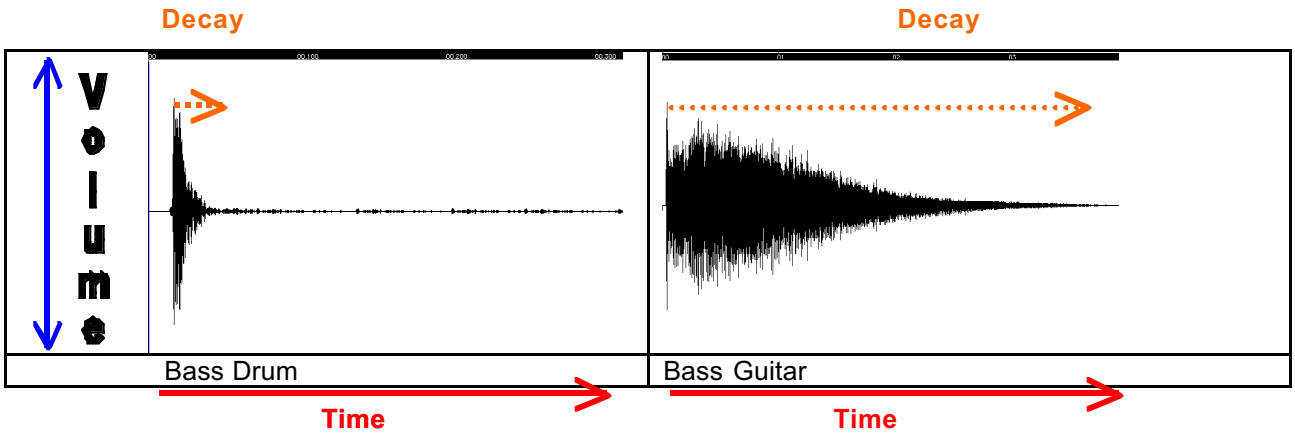
The ability to discern low, medium and high pitch sounds can also help the recordist determine optimum placement for the microphone. As the cassette tape recording medium is more efficient at reproducing low frequencies than high ones, positioning the microphone physically closer to the source of higher frequencies can give recordings greater clarity and fidelity. This is another reason to monitor with headphones while recording.

Duration

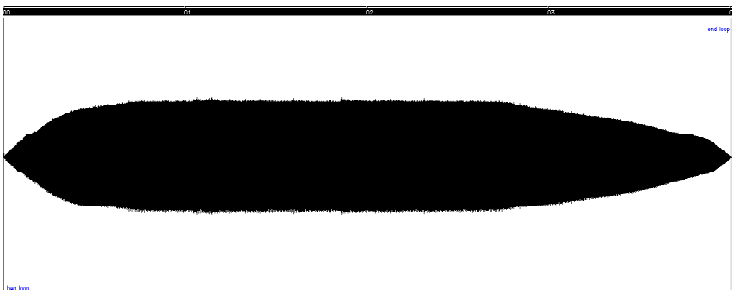
A key to imagining, recording and incorporating intriguing sounds comes from thinking about sounds adding variety, contrast and unpredictability the soundtrack. Beyond sounds that “go with” particular objects and settings, the sound editor is free to imagine any sound or quality of sound that one desires to hear at any given moment. Rather than slaving sound to image, the sound editor allows the soundtrack equal expression.

In addition to variation in tone and volume, the durations of the sounds used in a mix have an important role in establishing variety, expectation and composition.

Consider the sound impulses created by thumping a bass drum and thumping the low E string on a bass guitar. The two sounds are close in terms of tone and in terms of volume. What qualities are we hearing to be able to easily discern them?



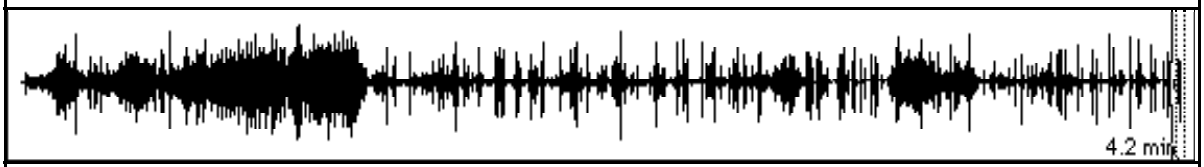
Waveforms, or graphs of each sound displaying the changes in volume over time provide a clear picture the difference we can hear. Both instruments have an abrupt beginning, but the way each sound ends (or "decays") is quite different. The volume of the strummed bass guitar string is sustained over three seconds while the sound of the drum decays fairly rapidly, in about 1/5 of second. Sounds with fast attacks and rapid decays are perceived as "**percussive**," whereas sounds with slow attacks and long decays seem "**sustained**" and create contrast.



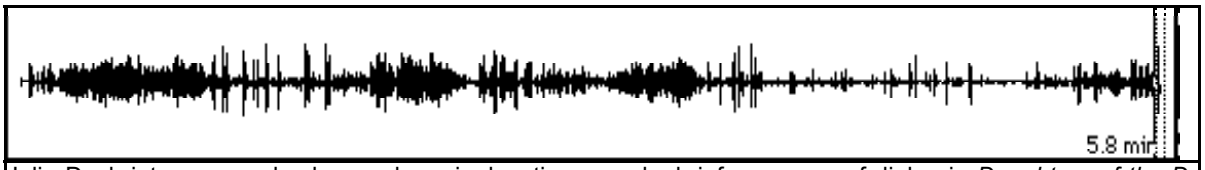
Sustained Guitar feedback

The notion of "Hi Fidelity" as goal in audio production is tied to the ability of the medium to use and portray a wide range of frequencies and volume levels. A film soundtrack as a time construction or composition portrays variety through passages that are soft, loud, percussive, sustained and combinations of these qualities.

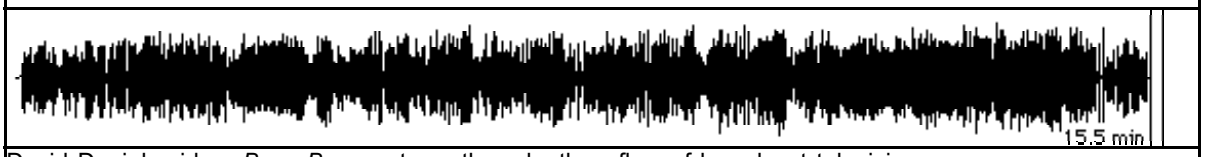
In a segment from Michael Moore's *TV Nation,* fast-paced, introductory voice-over stops abruptly and leaves audience wondering what is next. What follows is foreground music.



Steve Bogner begins his piece, *Personal Belongings,* with a percussive, dramatic music composition to ease monotony of a lot of narration that is to follow.. Another, brief music passage occurs about 1.5 minutes later

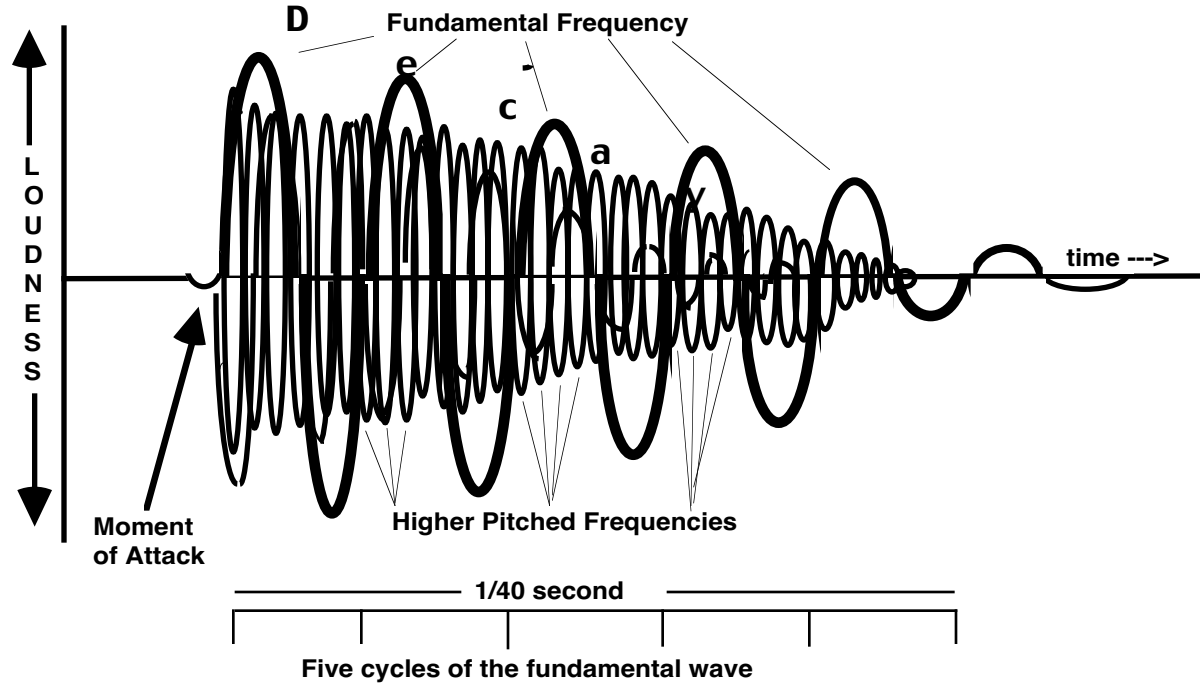


Julie Dash intersperses background music, location sounds, brief passages of dialog in *Daughters of the Du*
The location sounds occur in the sections with thin lines.



David Daniels video, *Buzz Box,* portrays the relentless flow of broadcast television

Anatomy of a Waveform



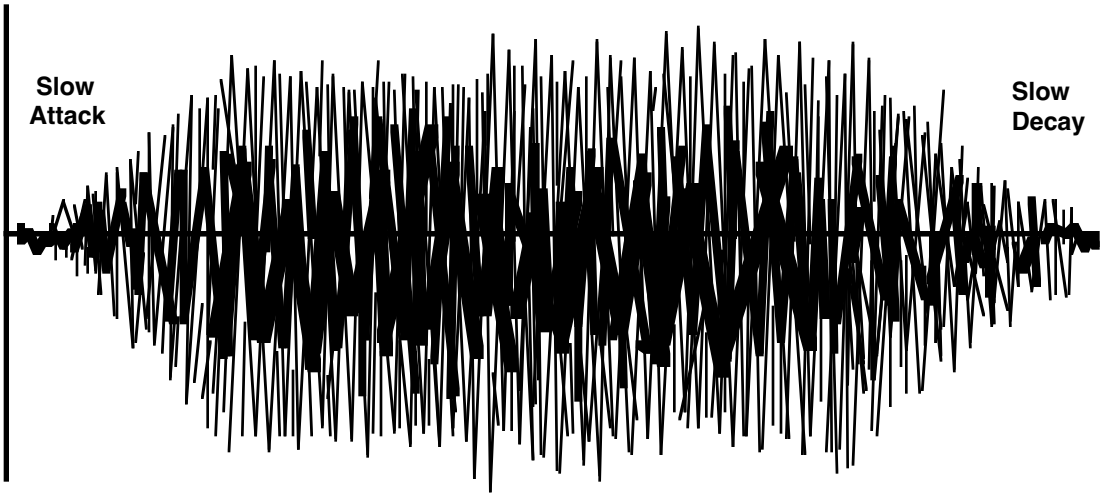
The symmetry of the image stems from the back and forth (up and down) pulses of the vibrations. The equally spaced, repetitive wave-like shapes are the frequencies inherent in this sound. As time is represented on the horizontal axis, the repetitive wave shape with the greatest width is the lowest tone-- the fundamental frequency. The repetitive wave shapes with shorter widths have higher tones.

The vertical thicknesses of the image relates directly to the loudness at a particular moment of time. The quick rise in volume at the beginning (the "attack") of the organ note is apparent, and as time passes, its volume decreases, or fades away (the "decay").

The simplicity of this waveform is significant. Its shape reveals that the sound is quick, short, highly structured with predominately low frequencies and a lack of high frequencies. (High frequencies would be represented by waves of very small widths). With five cycles occurring over a period 1/40 of

a second, the fundamental frequency is 40 X 5 or about 200 cycles per second. The embedded higher pitched tone is vibrating about 18 cycles or at 18 X 40 or 720 Hz. The sound is a very brief, low frequency but very pitched, "thump."

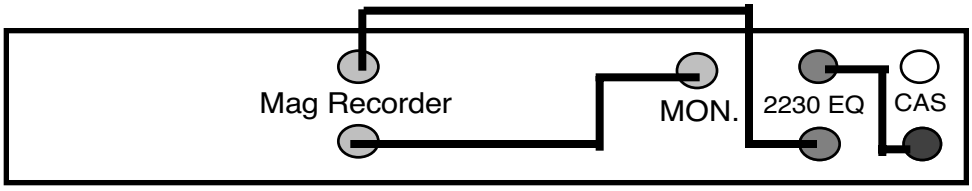
Less musical or "concrete" sounds like speech, clicks, buzzes and squeaks, also have frequency and loudness characteristics. The appearance of these waveforms is less structured and they often reveal a wider rang of frequencies. Here's a waveform for the sound "s" in speech.



A complex mixture of High Frequencies

Cassette Tape to 16mm Mag Film (Transfers)

Make this audio patch:



1. Check these buttons/switches:

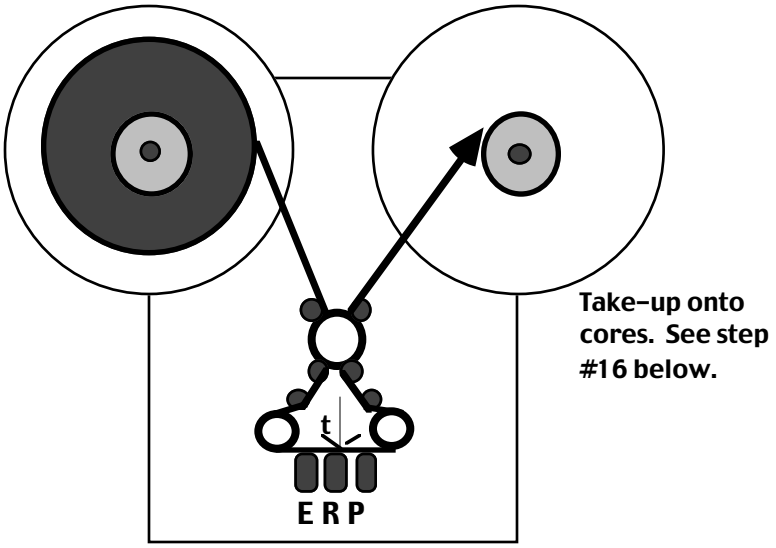
   16mm Mag Film Recorder
   Magnasync Record Amplifier Power Switch **ON**
   Record Level Knob at **5.5**
   Playback Level Knob at **6**
   First press yellow **"Ready"** button and than the red **"Record"** button.

   Cassette Player
   Dolby - **Off**

   Tapco 2230 Graphic Equalizer
   All white knobs in **centered** positions
   Red "Level" knob at **"Cal"**
   Press "EQ" button **IN**
   "32" and "8K" buttons **OUT**

   Fostex Audio Monitor
   Power on, Volume level to 10 o'clock.

2. Load 16mm Mag Film on the Recorder in A Wind configuration:



3. Check for adequate tension **(t)** against the Erase/Record/Play heads. Make sure that the rougher/duller magnetic particle side of the mag film is facing towards the heads (down).

Foreground Sound Calibration, Equalization and Record Level

4. Load cassette with your foreground material in the cassette player. If your tape does not contain a recording with a properly saturated voice (peaks to –3 to -5dB), make a cassette tape that does provide these reference levels and use it through calibration (step 5).

5. Play the foreground sound on the cassette tape. Adjust red "Level" knob on the Tapco 2300 so that -3/-5 dB peaks occur on the Mag Film Recorder Vu meter. Adjust audio monitor level for a comfortable listening level. Leave the monitor level fixed at this level as you work. Put the tape with the foreground materials you wish to transfer into the cassette deck.

Foreground Transfer
Peaks to –5 to -3dB

6. Cue up the section you wish to transfer and "zero" the counter. Listen to the section and adjust record level for –5 to –3dB peaks with the red knob on the Tapco 2300. Rewind and listen for tonal imbalances that could be lessened, Here are some of the more common problems to listen for and suggestions corrections to be tried with an equalizer.

Sound Source	**Problem**	**Equalization Suggestion**
Voice	Lack of clarity in speech. Bottom end of the voice sounds too pronounced and "bassy."	Cut from 2-6 dB in the range of 200-300 Hz and boost from 2-6dB in the range from 3K to 4K. If still too "bassy" experiment with cutting at 160Hz.
Voice	Voice sounds thin and "roomy" from micing at too great of a distance.	Cut room tone resonance in the range of ~300-450Hz. Try modest boost of 2-4dB in the range from 3K to 4K.
Voice	Voice has nasal quality	Try cutting at 650Hz and/or 1300Hz.
	Voice sounds rough and distorted but its not over-modulated	Try cutting some "chestiness" around 400Hz.
Voice or Effect	Recording has too much hiss	Tape hiss occurs from 3.5K to 10K. System noise goes from about 5K to 20K. Try each of the bands from 3K to 20K making note of the ones that seem to affect the hiss the most. Its pretty safe to cut above 8K without affecting clarity, Below 8K cut in as few bands as possible and when there is doubt, leave the hiss. More can be removed later
Voice or Effect	Key element is abrasive and harsh	Try these frequencies to see which has the most affect: 1600Hz, 2000Hz 2500Hz. 3500Hz.
Voice or Effect	Seems to lack volume and punch	Try boosting at one or more of these frequencies: 1600Hz, 2000Hz 2500Hz. 3500Hz.
Voice, Instrument or Effect	Too much high pitch energy, or distortion or seems to busy	Listen to the affect of cutting bands between 4K and 12k. Often it will be concentrated more in one bandwith.
Voice, Effect or Instrument	Sounds overpowering and aggressive	Find and cut the dominant frequencies in the instruments voice
Instrument or Voice	Sounds Horny and Tinny	Cut at 1600 Hz
Voice or Effect	Too much low frequency rumble from location	Modest cutting 125 to 200Hz.

Additional Equalization Tips:

Do not perform excessive low end cutting below 100Hz in B-65 because the small monitor speakers do not reproduce that part of the frequency spectrum very accurately. Wait to do this in the final mix stage using the large JBL 4412 monitor speaker system.

You will still be able to make equalization changes in the final mix stage as your skill and time permits. Go ahead and make the corrections that need to be made, they will make it easier to edit. Hold off on those corrections you are unsure of.

7. If you transferring critical material like voice-over that you might need to make additional transfers of, it's a good idea to record the Tapco settings that you used. Place a piece of

masking tape along the bottom of the row of white knobs on the equalizer. Starting from one end, write down the status of every knob in a sequence like:

-9 -9 -6 -5 -4 -2 -1 0 0 0 0 0 0 +1 +2 +4 +3 +1 0 0 0

Attach the tape record to wax paper and you can put it back on the equalizer

8. After setting equalization, re-adjust the red "Level" knob on the Tapco 2300 to establish -5 to -3 dB peaks on the 16mm Mag Film Recorder Vu meter. If the levels are consistent, you can leave the setting where it is and go to step #10.

9. If the playback volume of the foreground material drops or increases noticeably during playback, its best to even these out by adjusting the record level knob during the transfer. Here are some common situations & suggested corrections:

   The signal level slowly drops or slowly grows louder.

   Become familiar with the levels in the material by running through the take a few times. Pencil down where the Tapco level knob should be at the extremes and practicing making the level changes smoothly.

   Some sentences or statements are louder or softer.

   If there are some brief pauses in between them, its possible to perform some quick record level changes. Again, pencil down where the Tapco level knob should be for the passages and practicing making the level changes at the right moment.

   There are one or two very brief moments when the signal is very loud.

   These can cause the whole transfer to be too soft if you adjust the record level so these moments don't distort. Set the record level for -3 to -5 dB saturation for the bulk of the material and transfer the whole take (A). Set the record level for -3 to -5 dB saturation for the peak moments and transfer these segments alone (B). Then, on the Steenbeck,carefully cut-in/replace the distorted moments in transfer(A) with those from transfer(B).

10. Rewind the cassette to the head of the foreground material that you wish to transfer and place it in "play-pause" mode.

11. Turn on the take-up motors on the Mag Film Recorder by turning the knob on the right to "HOLD" and the knob on the left to "A Wind." The torque motors will start humming.

12. Start the Mag Recorder rolling by twisting the transport knob "FORWARD."

13. After the speed of the Mag Recorder stabilizes (about 1-3 seconds), start the cassette tape playing by releasing the pause button.

14. Let the Mag Recorder Roll all the way through the take making record level adjustments as necessary. Turn the Mag Recorder Transport Knob to STOP.

15. If it's your first transfer of the day, stop and play back the tail of the first take to make sure everything is working. Follow these steps:

    a) Press on the "Safe" (white) and "Repro" (green) buttons on the Mac Recorder amplifier.

    b) Turn the Transport knob to "REVERSE." The end of the first transfer should start playing in reverse. Roll back10 seconds or so and play the transfer in "FORWARD" to check it. If there is a wobble, the tension is too loose on the Mag Recorder. If there's no signal, your patch is probably wrong or the magnetic particles are facing away from the Mag Recorder heads (B wind).

    c) If everything checks out, play forward and STOP the Transport about 5 seconds after the end of the take.

16. A big time saver when you are sound editing on a 4 or 6 plate is to take-up each of your transferred segments on separate cores (2" or 3"). This way you won't have to search through a whole roll of material whenever you need to add a sound. Let the Mag Recorder roll an extra 5 seconds after each take. Use scissors to cut the mag film where it meets the take-up reel. Remove the take-up split reel and the cored, transferred mag. Attach the loose end of the transferred piece with white tape and label it with a Sharpie on its own core. Just remember that these cores are tails out.

17. Turn -off the Take-Up motors of the Mag Recorder while you set-up for the next transfer by switching the "A Wind" knob off.

Background Sound Record Levels & Equalization

Transferring background material is the same mechanical procedure except for different record saturation levels and different equalization considerations.

Background tracks usually run continuously. When editing on a 4 or 6 plate, the background tracks are probably going to be cut back-to-back on a single Mag roll (Mag 3). As a result, large volume differences between them are hard to correct in the mix. Here are some tips:

- Always leave the speaker level fixed after you calibrate the system and in step #5 above. If you are only transferring background material, do step #5 first.
- Don't change the record level during a background transfer. These are best left for the final mix.
- Keep background transfers consistent. Use the "fat needle" guidelines described below to transfer all of them about the same loudness. They will flow together better and you can always fade a track quickly up or down for dramatic effect during the final mix. Using headphones can help drown-out the Mag Recorder sounds when judging loudness.

18. Press the "Ready" and "Record" buttons on the Mag Film Recorder Amplifier.

19. Place the cassette with the background recording in the cassette deck.

20. Return all of the white equalizer knobs on the Tapco Equalizer to the centered positions.

21. Play the background sound and adjust record level on the Mag Recorder Vu Meter with red "Level" knob on the Tapco 2300 Equalizer. Background sounds should be transferred so that the Vu Meter needle barely moves ("fat needle.")

Background Transfer
Peaks to –20dB or “Fat Needle”

22. Make adjustments in equalization as necessary. Typically, urban background sounds have a wide range of tones but with much greater emphasis in the lowest frequencies 40-300 Hz. The size by means of “air” in a location recording can be often be increased or decreased by boosting or cutting loudness in the 900 Hz -1200 Hz range. An exterior recording can be made to seem like its passing through walls by making a fairly sharp "roll-off" of frequencies *above* 300 Hz. Avoid major changes to levels below 200 Hz at the transfer stage because they can be adjusted easily in the final mix stage. There may be excessive hiss in a background recording if the setting was very quiet and the record gain had to be turned all the way up. For background tracks, it’s safe to cut everything above 8K Hz.

Sound Source	Problem	Equalization Suggestion
Urban Day Exterior	Dominant drone-like low tone that is too loud	Try all the sliders between 120 and 500Hz to determine which ones affect the dominant tone or tones the most and cut these.
Urban Park Presence	Leaves blowing in wind creates a high pitched sizzle that is too energetic.	Locate sizzle and cut it. Look in the range between 4K and 12KHz..
Urban Day Exterior	Rumble of City is too pronounced, gives the recording too much “drive” and energy.	City rumble can be reduced by cutting around 125Hz. If –12dB is not enough, cut 30Hz at –12dB, next at little at 160Hz/
Lakefront Waves	Roar is too loud. Can’t seem to get it to sound like a location	If the recording was made close to the water, best to regard it as an effect and use another background track without the lake to establish the background.
Department Store Interior	Low pitch, sustained tones are too loud.	Try all the sliders between 120 and 500Hz to determine which ones affect the dominant tone or tones the most and cut these.
Factory Interior	No “Air” place seems very small and too inactive.	Boost 900Hz. If this doesn’t make the space feel more open, cut some of the low tones between 120 and 500Hz. Can also boost a little around.1000 to 1.3K.
Urban exterior with water fountain.	Can not create a background feeling with this file.	Best to regard background recordings with high pitched sounds like water as an effect.
Very Large Reverberant Interior	Recording has too much reverberation.	Reverberation may be more concentrated in the lower mid-range. Try cutting in the range of 300-800Hz.
Rural Birds	Energy is too high, not mellow enough.	Cut High frequencies 4-8KHz to make the sound of the birds less bright.
City Presence	Has too many audible cars and doesn’t seem far away.	Cut High frequencies 4-8KHz to lessen the sound of the cars,
Interior Cafe	Has pronounced 60Hz hum from a machine in the place.	Try modest cutting at 60, 120, 180, and 240 Hz.

23. Rewind the cassette to the head of the background material that you wish to transfer and place it in "play-pause" mode.

24. Turn on the take-up motors on the Mag Film Recoder by turning the knob on the right to "HOLD" and the knob on the left to "A Wind."

25. Start the Mag Recorder rolling by placing the transport knob into "FORWARD." Let the Mag Recorder run until you have plenty of material.

26. Turn -off the take-up motors of the Mag Recorder while you set-up for the next transfer by switching the "A Wind" knob OFF.

Middle-Ground Sound Record Levels & Equalization

Transferring middle-ground material involves the same procedures except for different saturation and equalization considerations.

Middle-ground sounds are usually short in duration and rich in high frequencies. In the final mix, the loudness of middle-ground "effects" is only slightly above that of background sounds. To promote a sense of greater distance from the listener, low and high frequencies are often equalized out off middle-ground sounds.

Because of their percussive nature, care must be taken to not over-saturate the Mag film during the transfer.

27. Press the "Ready" and "Record" buttons on the Mag Film Recorder Amplifier.

28. Place the cassette with the middle-ground sound in the cassette deck.

29. Return all of the white equalizer knobs on the Tapco Equalizer to the centered positions.

30. Play the background sound and adjust record level on Mag Film Recorder with red "Level" knob on the Tapco 2300 equalizer. Middle-ground sounds should be transferred with peaks at -10 dB, maximum. For very sharp effects, set record level for -15 or -20 dB.

Middle-Ground Transfer
Peaks to –10dB

31. Make adjustments in equalization as necessary. See suggestions below.

Sound Source	**Problem**	**Equalization Suggestion**
Pencil Writing	I can't make this close-mic'd recording seem like the writing is in the middle-ground.	Roll-off the frequencies in a curve from 3K-20KHz and from 400Hz to 20Hz.
Buzzing Fly	The background traffic is too loud when I try to use this as a middle-ground effect.	Roll off the low end frequencies from 1000 Hz to 20Hz. The fly buzzing is comfortably above 1000Hz.
Trickling Water	Can't make this close-mic'd recording seem like it's in the middle-ground.	Roll-off the frequencies in a curve from 3K-20KHz and from 200 Hz to 20Hz.
Traffic in Street	Trying to get the traffic to sound like its coming into an apartment from the outside	Roll-off the frequencies in a curve from 500Hz- to 20KHz.
Music	I want to make it sound like its coming from a muzak-like speaker system.	To get a thin tinny sound, roll-off the frequencies in a curve from 2K-20KHz and from 1000 Hz to 20Hz.
Voice	How do I make a voice sound like its coming through a cell phone?	Roll-off the frequencies in a curve from 2K-20KHz and from 1000 Hz to 20Hz. Make the curves steeper if necessary.
Steel Ductwork	I want to make thumps on this dust seem further away.	Roll-off the frequencies in a curve from 2K-20KHz and from 600 Hz to 20Hz. Make the curves steeper if necessary.
Lounge Conversa-tion	The voices seem too close and have too much energy.	Roll-off the frequencies in a curve from 2K-20KHz.
Crickets	Can I get rid of the Air Conditioner sound and save the crickets	Roll-off the frequencies in a curve from 2K-20KHz. Make the curve as steep as necessary until the air conditioner hum is diminished.
Axe Chopping	How do I make this sound like its far away?	Roll-off the frequencies in a curve from 1K-20KHz. Make the curve as steep as necessary until the sharpness sounds dull, Boost the lower midrange from 400Hz to 900Hz. Roll-off the frequencies in a curve from 300Hz- to 20Hz.
Machine Drone	How can I make this drone sound richer/fuller?	Fins and cut the dominant frequencies in the 125 to 50Hz range. Find and modestly boost resonant mid-range frequencies in the 400Hz to 1600Hz range.

32. Rewind the cassette to the head of the middle-ground material that you wish to transfer and place it in "play-pause" mode.

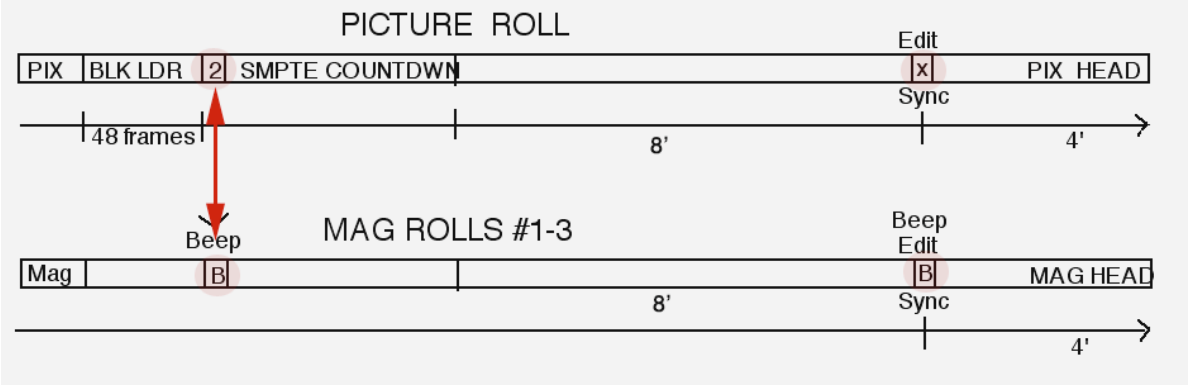
33. Turn on the take-up motors on the Mag Film Recorder by turning the knob on the right to "HOLD" and the knob on the left to "A Wind."

34. Start the Mag Recorder rolling by placing the transport knob into "FORWARD." Let the Mag Recorder run until you have plenty of material.

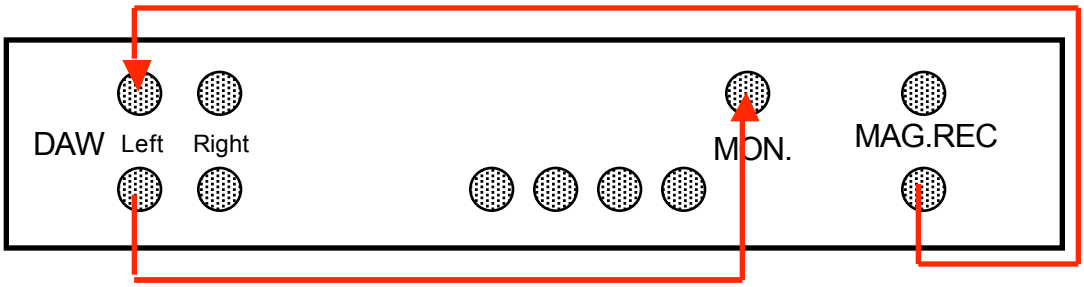
35. Turn -off the take-up motors of the Mag Recorder while you set-up for the next transfer by switching the "A Wind" knob OFF.

Transferring Edited 16mm Mag Tracks to LOGIC

The Picture Roll and all Three Mag Rolls need to be leadered like this:



Make this audio patch:



MAG 1 TRANSFER (Foreground sounds):

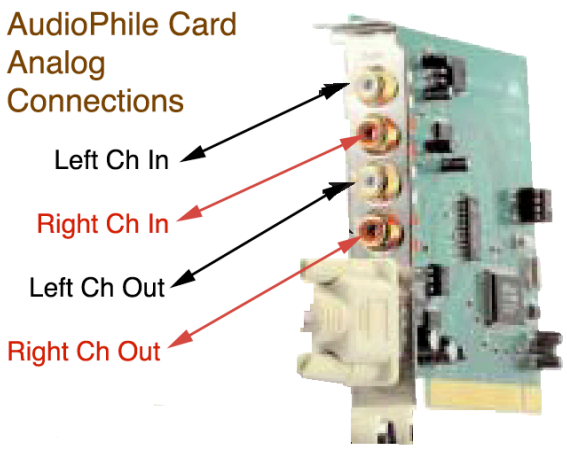
1. Check these buttons on the16mm Mag Recorder Amplifier:
   Black Power Switch On
   Press **"Safe"** and "Repro" buttons in this order.
   Set "Reproduce" knob to "6."

2. Load Mag 1 on 16mm Mag Recorder/Player. Put in "Reproduce" mode.

3. Turn on the power to the Monitor Amp.

4. Make sure you are working on the Mac platform equipped with the M-Audio AudioPhile Card. The following equipment is also needed: Monitor, keyboard, mouse, headphone amplifier with Sony Stereo Headphones and 1/4" stereo plug adapter. You will need some blank CD-R disks.

5. Make sure the audio cables are connected between the Sound Cart and the Mac Computer. Look for sound card in the rear of the Mac. Four cables should be connected to the RCA connectors shown here:



Using your Own Computer for Final Mixing

For your final BEII project, you are required to cut three tracks of Mag sound (background, middle-ground and foreground) on the Steenbeck exploring image-sound relationships before using a digital system to finish your mix. You may take the digital transfer files from the edited Mag tracks home, use your computer to finish your mix, bring the digital mix file back to B-65 to transfer to 16mm Mag film, and sync the mix with your 16mm picture on a Steenbeck. Final Projects must be screening in 16mm double system. Should the instructor feel that you have not created the three, required edited Mag tracks, she/he may ask to see them.

If you will be working at home on a Mac, an external FireWire is useful. If you are working on PC, it's probably easier to use CD-R disks for transporting the digital sound files back and forth. If you plan to do the mix for your soundtrack on a PC computer and use an external FireWire drive, consult the technical information in the Student Index on the Film Department website:
http://www.uwm.edu/~type/FilmDept/StudentIndex.htm

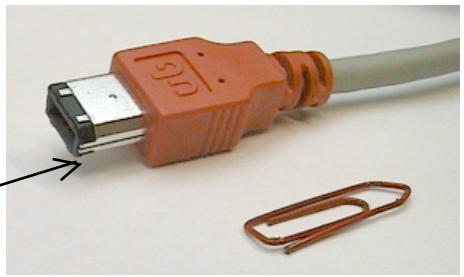
Connecting an External FireWire Drive

6. Make sure the Mac is OFF. Note: The monitors can go into sleep mode where the screen is dark but the Mac is still on. Check the blue light on the front of the G5 cabinet. If the light is on, THEN THE COMPUTER IS REALLY ON! The computer must be off before connecting or disconnecting an external drive, no exceptions.

Warning

If you forget and hook-up or remove a FireWire external drive to a computer that is already on, do not attempt to mount/re-mount it. Restart the computer and let the drive mount itself as usual. Failing to do so risks serious data loss. The practice of dragging FireWire partitions to the trash and removing the FireWire while the computer is ON can lead to data loss.

7. Connect the FireWire (FW) drive to a FireWire jack on the Mac (front or back). Note that one side of FW connectors is slightly curved. Make sure that you align this curved side when you insert a cable. Forcing it in backwards will destroy the connector.



Starting the Computer

8. If you are using a FireWire drive, turn it on first. After you hear it spinning, press the Start button on the front of the Mac.

9. If you are using an External FW drive, look for its icon on the desktop. If your FireWire drive does not mount, shut down the Mac and make sure the drive's power is on and the cable is fully inserted at both ends. Restart. If the FW drive still does not mount, scan the bus with DISK WARRIOR and select the drive from the list to mount it. If this doesn't work, get help from the instructor.

!!!!!!! Disk Warnings !!!!!!!

Most serious problems with hard drives stem from two sources: (1) Installation or removal while the computer is running and (2) Failure to complete a writing task due to a "hang" (frozen cursor). The problems created usually surface when starting the computer as (A) a failure to mount or (B) a warning prompt saying the drive is not initialized with an option to INITIALIZE IT. Clicking "OK" to this will cause the data on the drive to become inaccessible! When encountering this prompt, respond "Cancel." Let the boot continue and use DISK WARRIOR to rebuild the disk's directory. If Disk Warrior does not show your drive in its scan, ask the instructor for help.

LOGIC & AudioPhile

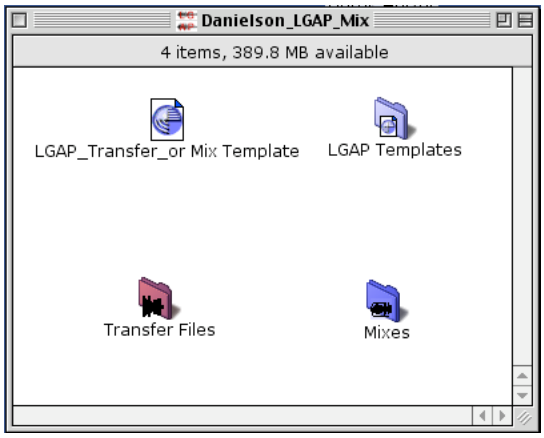
Software developers make their products to work with many audio cards and models of computers. For an audio recording and mixing program to be able to receive and send digital audio, a unique set of instructions for each type of card. These "connecting" instructions between the CPU and the audio card are programmed in a document called an AUDIO DRIVER. Currently, we have four different types of audio cards to facilitate in the Department. The one you need to be able to recognize for this class is called, "Core Audio. The term, "LGAP" will be used refer to the driver/settings required. This is the driver/setting that will be used in transferring analog sound from and to 16mm Mag Film in MIT B-65 using the AudioPhile card and the Delta Audiophile Core Audio driver. The icon associated with it looks like this:

Creating and Organizing Your Logic Session Folder

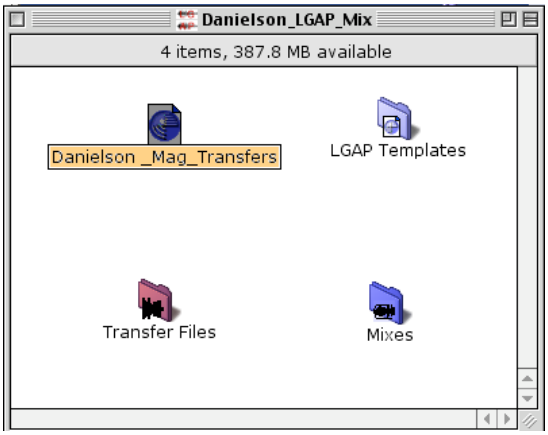
Sound files need to be stored where you can find them. Most computer programs are designed to automatically keep track of assets (“media” files like sound files, QuickTime movies etc.) that are placed within the same folder as the main project document. In Logic, this “editorial” document has the Logic icon on it.

10. The instructor has created a folder on a hard drive partition of the computer with your last name on it. That will be where you create your mix. Use Sherlock (Apple-F) and enter, “your last name,” and press return. Click on the folder Sherlock and see where it is located on the Mac. Navigate and find it.

11. Look for the custom folder titled, Your_Last_Name_LGAP_Mix;” Open up this folder and it will look like this



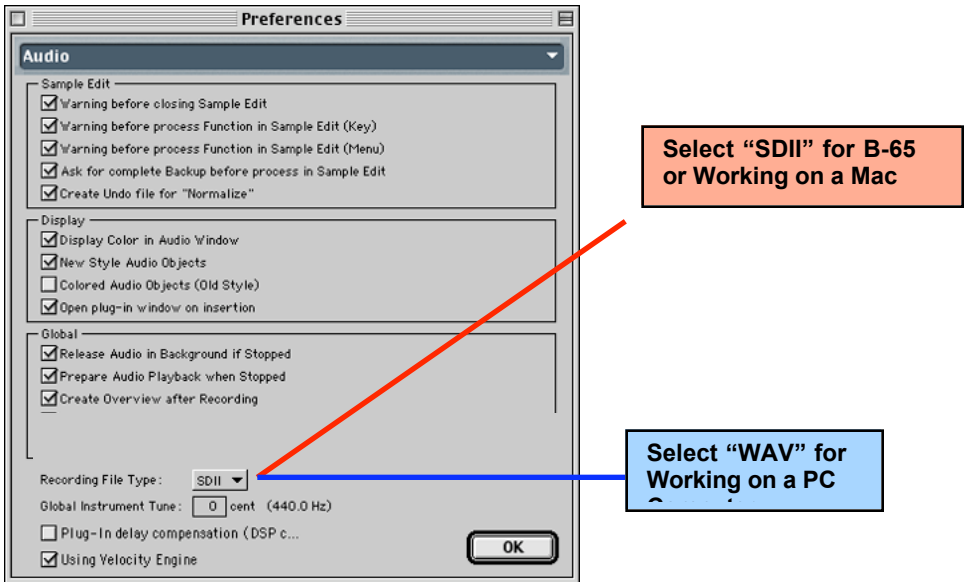
12. Click on the title bar of the Doc named,” LGAP_Transfer_or Mix Template” to highlight it. In the title area type, “YrName_Mag_Transfers”



Selecting File Creation Type

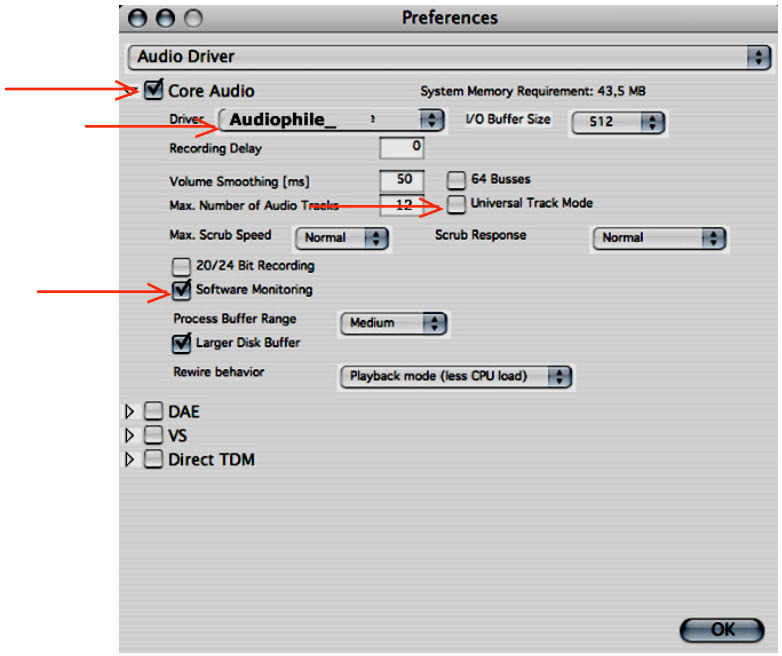
13. The doc you just named, “YrLastName_Mag_Transfers” is a session doc for the application, LOGIC, double click on it to launch LOGIC.

14. If you are going to be mixing in B-65 or working at home on your own Mac, under Audio -> Preferences, in the window that opens up, select, “SDII” in the pull down window where it says, Recording File Type.”


Preferences
Audio
Sample Edit
Warning before closing Sample Edit
Warning before process Function in Sample Edit (Key)
Warning before process Function in Sample Edit (Menu)
Ask for complete Backup before process in Sample Edit
Create Undo file for "Normalize"
Display
Display Color in Audio Window
New Style Audio Objects
Colored Audio Objects (Old Style)
Open plug-in window on insertion
Global
Release Audio in Background if Stopped
Prepare Audio Playback when Stopped
Create Overview after Recording
Recording File Type: SDII
Global Instrument Tune: 0 cent (440.0 Hz)
Plug-In delay compensation (DSP c...
Using Velocity Engine
OK
Select “SDII” for B-65 or Working on a Mac
Select “WAV” for Working on a PC

15. <u>If you are going to be mixing at home on a PC computer</u>, under Audio -> Preferences, in the window that opens up, select, “WAV” in the pull down window where it says, Recording File Type.”

16. Under_>Audio-> Hardware / Audio Driver, in the window that opens, open the CORE AUDIO entry by clicking the arrow next to it and check settings:



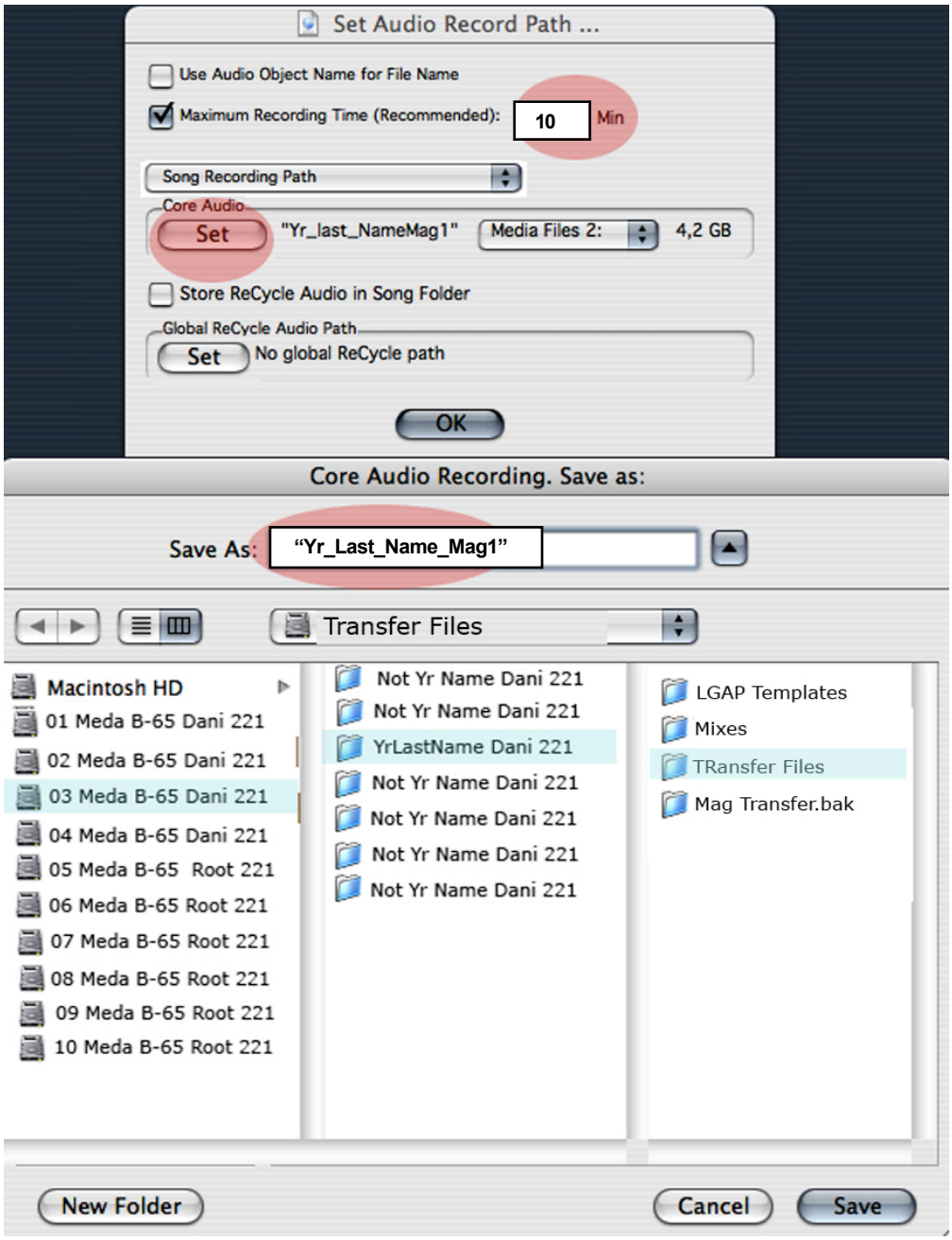
Note: If you do not find the AudioPhile driver listed after “Driver,” select it from the pull-down window. Any time you change the driver, you need to save the Logic session, quit Logic and re-launch it again by double clicking on the “YrLastNameMagTransfers” doc again.

17. Under AUDIO_>Sample Rate, check for 44.1K

18. Under AUDIO -> Set Record Path, do the following:

    a. Set record time to 10 minutes. (click on the number, drag up or down)

    b. Click on SET and a window opens. Name the file, “Yr_Last_Name_Mag1” and direct it to be recorded in the folder named "Transfers" by navigating to your partition, Session folder and to the “TRANSFERS” folder. CLICK SAVE.

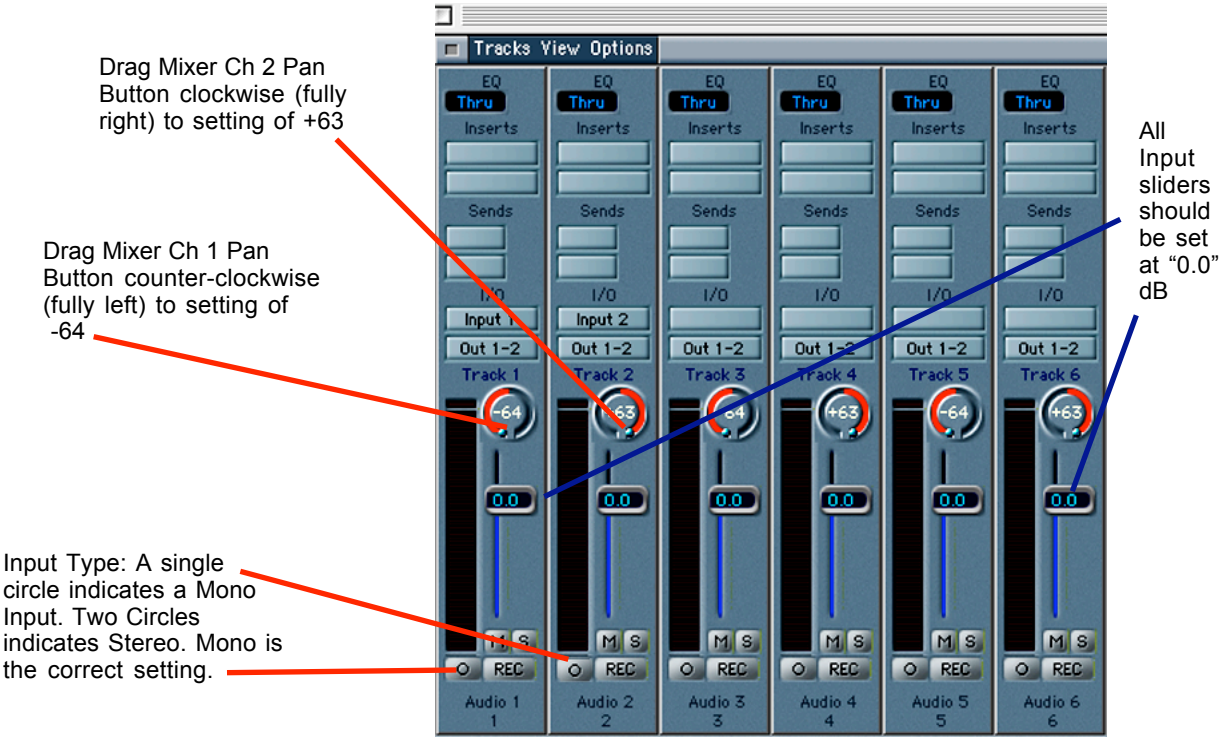


NOTE: If you get a prompt after clicking on SET above a driver not being available, its likely you have not set the driver correctly or did not save and restart LOGIC after changing a driver setting. To fix this, save your Session, Quit Logic and re-launch LOGIC and repeat steps 15-120.

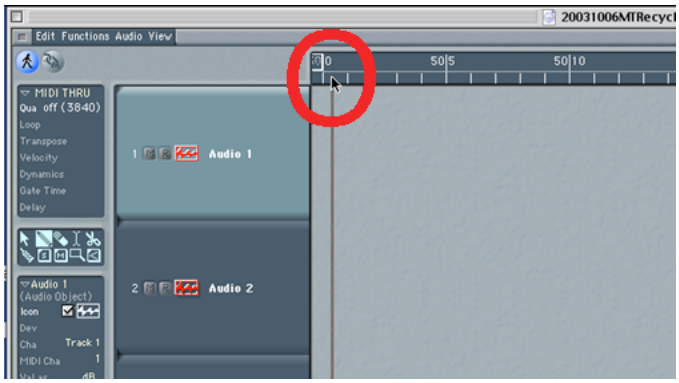
Sometimes a LOGIC Session template can become corrupt. The Fix for this is to create a new template by choosing FILE→ NEW in Logic and then go through the same preferences you checked above. Let the instructor know if you discover this situation so the corrupt Session can be tracked down.

19. If not already preset in the Mixer window, pan Channel 1 fully Left (to -64) and Channel 2, fully right (to 63). Make sure there are “o” (mono) icons at the bottom of all of the channels indicating that they are controlling mono signal inputs. If no, click and hold one them individually and

select, “o”. Make sure the input levels on all of the channels are set to “0.0” (To reset an input slider to “0.0,” hold down on the Option key and click the square button on the slider once).



20. Place the current position indicator to the start of the timeline Arrange window.



21. Load Mag Track 1 (foreground) onto the Magnaync Recorder/Reproducer and place it in Play mode.

22. In the Mixer Window, click on the “REC” button for Channel 1. The audio from the Mag Deck should come through the Monitor speaker and show up in the level meter in Ch1. If there’s no audio follow the below steps.

If No Audio Comes Through

A) Make sure the patch cables connected correctly (see start of this section). Make sure the Fostex Monitor Speaker is on and volume turned up. Make sure you are not playing a section of Mag1 that has no audio.

B) If still no sound, make sure the amplifier for the Mag Deck is turned on, the Safety and Reproduce buttons are pressed in, and the Reproduce knob is set at 6.

C) If still no sound, Check the four RCA cables between the Sound Cart and AudioPhile Card

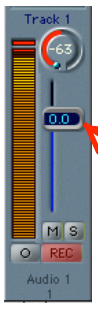
D) Under AUDIO -> Audio Hardware and Drivers: Make sure Core Audio AudioPhile driver is checked and the other items are also set correctly. Make any changes necessary, save and quit LOGIC and restart. Look in the Arrange Window to see that the right driver "CoAu is assigned to Ch 1 and Ch 2. If not, click and hold on the other term (such as "Mac AV") and select "CoAu."

23. Assuming the sound is passing, cue up the Mag DECK a few Feet before the Edit Sync "Beep" tone.

24. Play through the entire Mag 1 Track. The foreground sounds from cause **Record Level** fluctuations in Track 1 of the Mixer Window. Adjust the Mag Deck Reproduce (Playback) knob so that the loudest moment on the entire Track goes all the way to the top of the scale WITHOUT causing the red **Over-Modulation** light to stay on. Click on the red Over-modulation light to turn it off. Play Mag 1 as many times as you need to set the right level.

The **Record Level** is shown in Track 1 of Mixer Window

Over-Modulation is indicated by the top red light turning on and staying on. Use a playback setting on the Mag Deck Reproduce knob that will produce strong peaks without ever turning the red Over-Mod light on.



You should be able to adequately adjust the record gain with the Mag Deck "Reproduce" knob, If you need additional boost or cut, you may also move the control knob on Track 1. You can't adjust this during the recording process though!

25. After you have established a record level setting, adjust the monitor speaker volume to a comfortable listening level. Rewind Mag 1 at least 3 feet before the EDIT SYNC Beep. For the Transfer, its best to place LOGIC into record Mode before starting the Mag Deck Playing.

26. Make sure the current position indicator is near the start of the arrange window. Click on the ROUND icon button on the transport bar to place LOGIC into Record Mode. (You can access the Transport window from “Windows” if necessary).

Clicking on the button with the large ROUND icon places LOGIC into Record Mode.

27. As it records, the digital waveform for Mag 1 is built in Track 1.

28. When the Mag Track 1 has finished playing, stop the transfer by clicking on the **SQUARE, STOP BUTTON** of the transport Window. (Using “Pause” can destroy the transfer file)

29. Under File->Save. To make sure that it recorded without flaws, play back the sound file. Click on the red “REC” button at the bottom track 1 to turn it off. Click the current position near the head of the file (left side) and either press the space bar or click on the triangle FORWARD button. Listen for distortion or click and pops. If there are problems, record it again just as the instructions show for Mag #2 (keep the first version for comparison).

MAG 2 TRANSFER (Middle-Ground Sounds):

30. Click on the red “REC” button at the bottom track 1 to turn it ON. Load Mag Track #2 on the Mag Deck. Click-place the current position marker after the transfer you just recorded in Track #1:

31. To name the Transfer file for Mag#2, select AUDIO -> Set Record Path and:

    a. Set record time to 10 minutes. (click on the number, drag up or down)

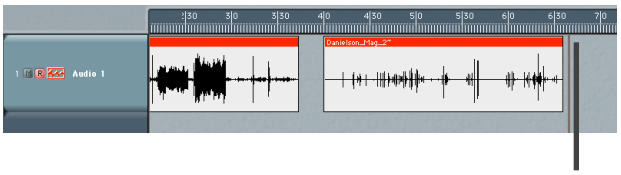
    b. Click on SET and a window opens. Name the file, “Yr_Last_Name_Mag2” and direct it to be recorded in folder named "Transfers" by navigating to your partition, Session folder and “TRANSFERS” folder. Click SAVE.

32. Play through Mag 2 adjusting the Deck's Reproduce knob (Playback Level) so that the loudest moment goes to the top of the scale WITHOUT causing **Over-Modulation**.

33. Rewind Mag #2 at least 3 feet before the EDIT SYNC Beep, click on the ROUND to place LOGIC into Record Mode. Play MagTrack#2 watching the levels to make sure it does not over modulate. Stop and select under File->Save.

MAG 3 TRANSFER (Background Sounds):

34. Load Mag Track #3 on the Mag Deck. Click-place the current position marker after the 2nd transfer in Track #1:



35. To name the Transfer file for Mag#3, select AUDIO -> Set Record Path and:

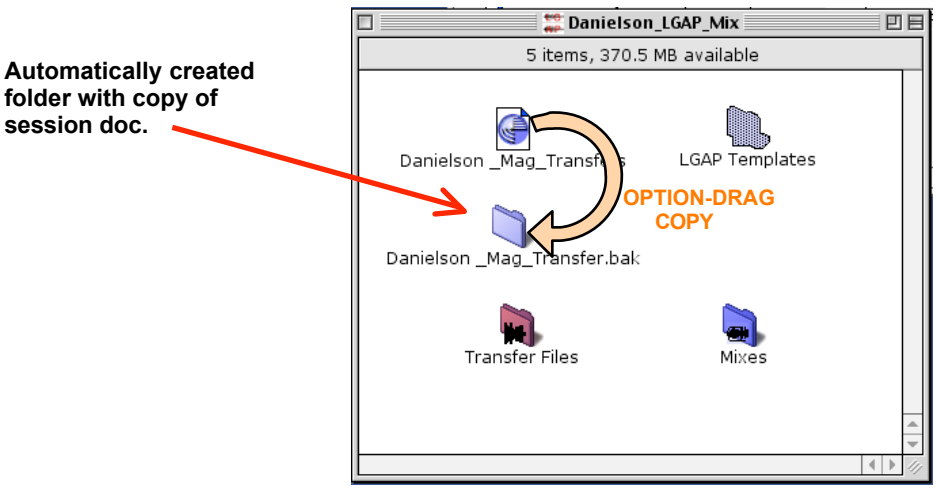
    a. Set record time to 10 minutes. (click on the number, drag up or down)

    b. Click on SET and a window opens. Name the file, "Yr_Last_Name_Mag3" and direct it to be recorded in folder named "Transfers" by navigating to your partition, Session folder and "TRANSFERS" folder. Click SAVE.

36. Play through Mag adjusting the Deck's Reproduce knob (Playback Level) so that the loudest moment extends about 1/2 up the scale.

37. Rewind Mag #2 at least 3 feet before the EDIT SYNC Beep. Click on the ROUND icon to place LOGIC into Record Mode. Play Mag #3 watching the levels to make sure it does not over modulate. Stop and select under File->Save. Quit Logic.

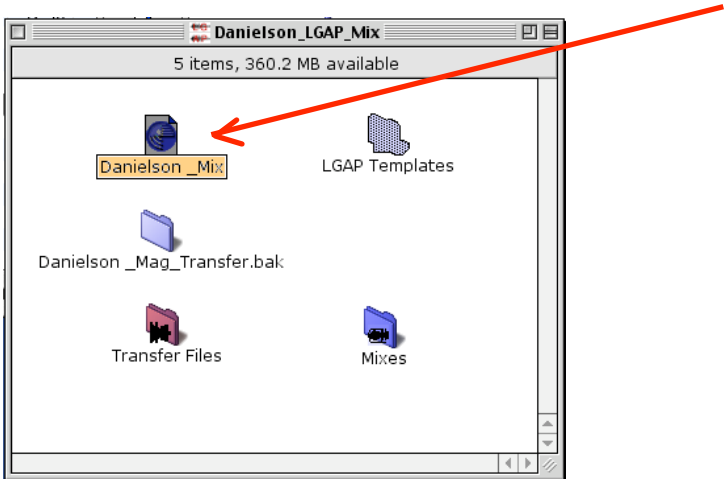
Saving Your Transfer Session Doc



When you saved your Logic Sesson, it automatically created a back-up in folder named, “YrName_ _Mag_Transfer.bak” that was also created. It’s a good idea to save your session doc at this point. To do this. OPTION-DRAG the doc, “YrName_Mag_Transfers” into the “Danielson_Mag_Transfer.bak” folder and release the mouse. Notice that your Session doc containing your MagTransfer digital sound files is still in place. We will re-name it and use it to continue working towards your final Mix.

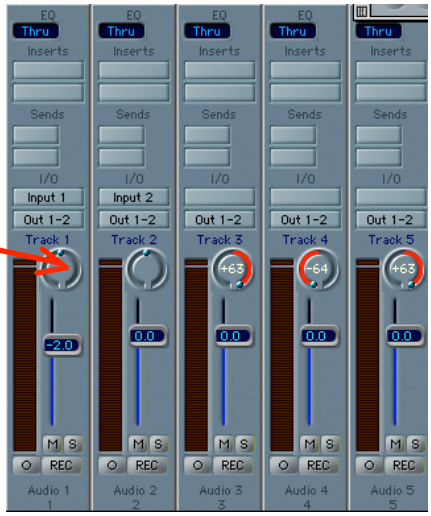
Synching Up Your Tracks

1. Click on the title bar of the doc, “YrName_Mag_Transfers,” and change it To: YrName_Mix,”

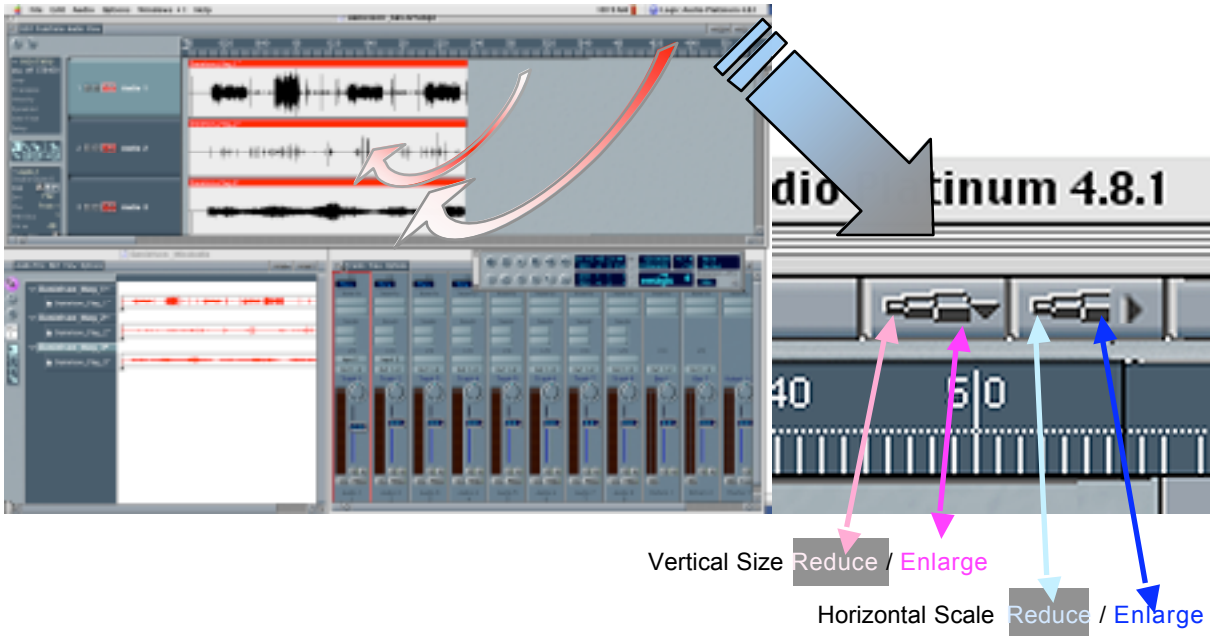


2. Double click on the doc you just renamed to launch LOGIC. OPTION-Click all of the PAN knobs in the Mixer Window . Tracks 3, 4, and 5 below have not been center-panned yet.

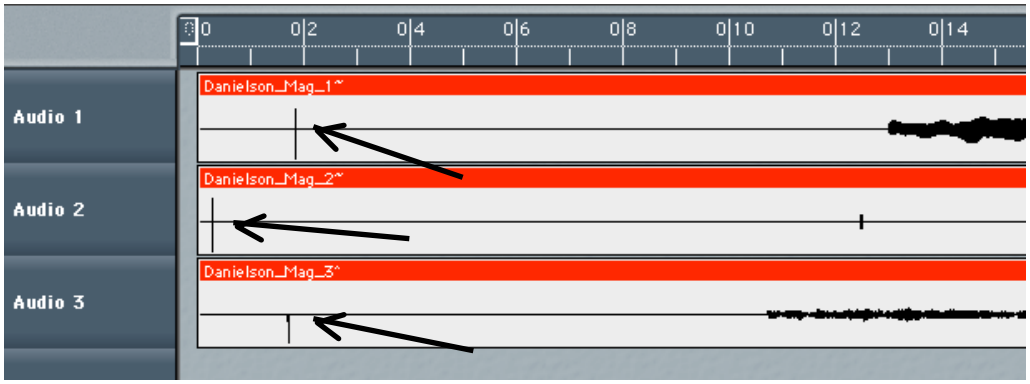
Hold down on the OPTION key and click each of the Pan knobs sending the outputs from each track to Center.



3. Use the Vertical and Horizontal Enlarge and Reduce buttons in the top right hand corner of the Arrange Window to show the top three Tracks. Click-drag your Mag #2 Transfer into Track #2 of the Arrange Window placing it beneath Mag #1 Transfer: Do the same for Mag #3 Transfer. Drag it into Track #3 of the Arrange Window placing it beneath the Mag #2 Transfer:

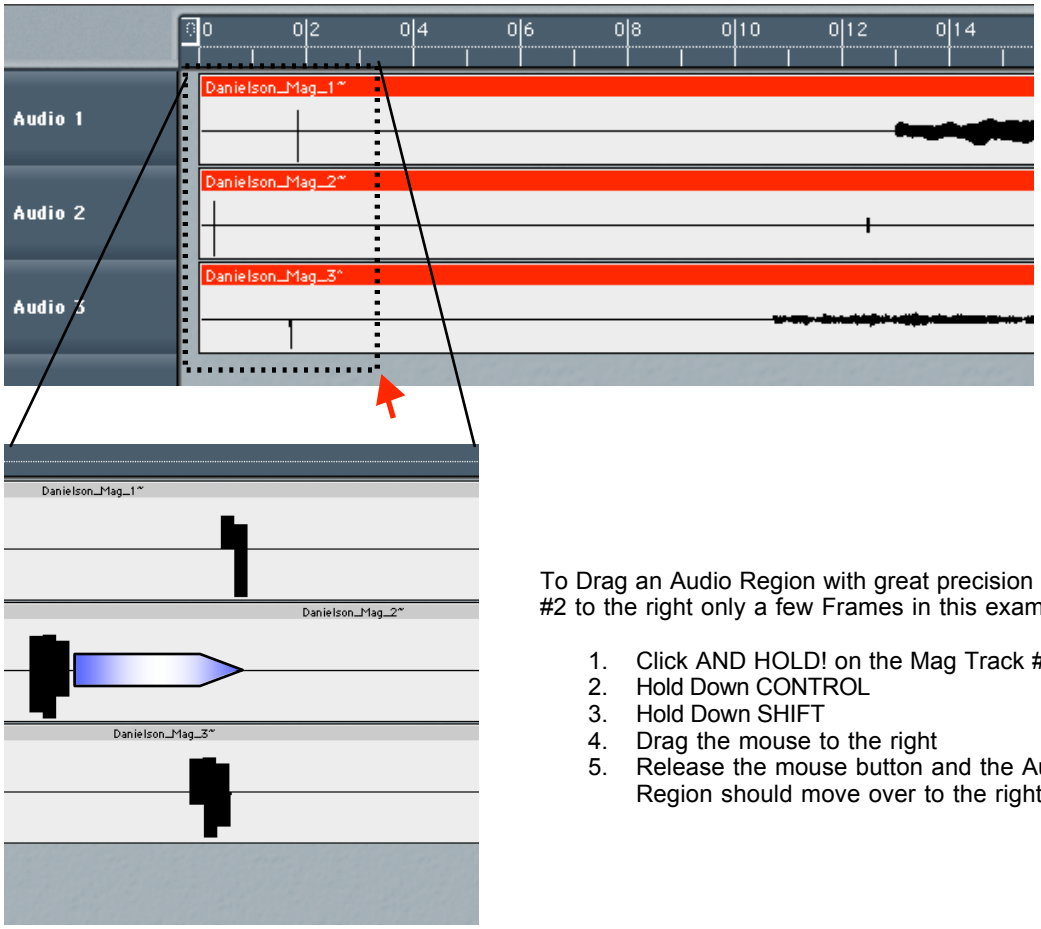


4. Use the Enlargement Button to “zoom” into the head of all three Transfer Files:



You should be able to see the “beep” frames that correspond with the “EDIT SYNC” frames of all three MAG Transfers.

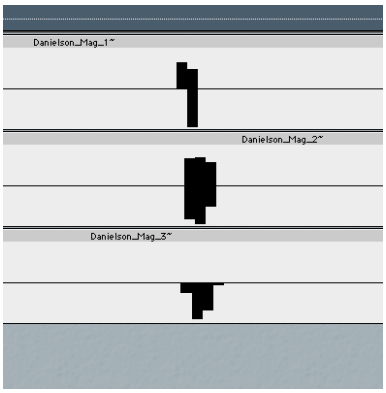
5. To Zoom in even further, **CLICK** in the ***“empty”*** gray area below the audio files, hold down the Control key and “LASSO” the area you would like to zoom into. Release Mouse Button.



To Drag an Audio Region with great precision (like Mag #2 to the right only a few Frames in this example):

1. Click AND HOLD! on the Mag Track #2 Region
2. Hold Down CONTROL
3. Hold Down SHIFT
4. Drag the mouse to the right
5. Release the mouse button and the Audio Region should move over to the right.

6. With a little practice, you can line-up all three, one frame, EDIT SYNC Beep Frames very accurately.



7. To listen to a rough mix, OPTION Click once in the empty gray area and the Lasso will “step-back” one setting to the prior view/magnification. Click the current position marker just before the sync marks and press the space bar to play all three the files. To adjust relative volume between the three tracks, use the sliders in the Mixer window for Tracks 1-3.

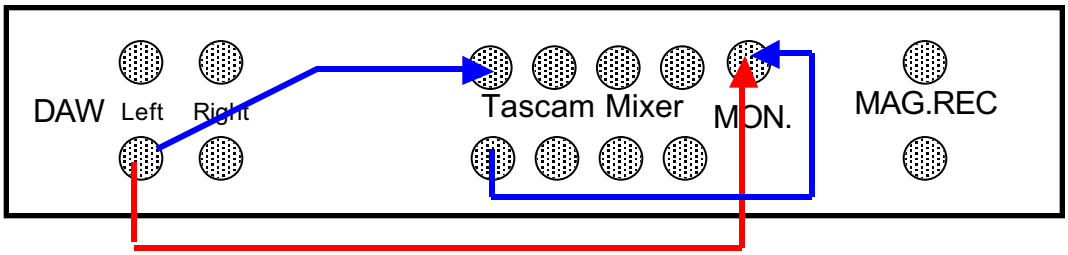
   Next, we’ll learn how to make precise volume changes through “rubber band automation” and adjust the tone of certain sounds through equalization “effects plugs.”

8. Save your Logic Session and quit Logic. If you are going to work on your own computer at home, you can drag-copy your whole Project Folder to a 100mb ZP disk for transporting. About 15 minutes of sound will fit onto each 100 mb Zip disc (monaural format @44.1K @16bit). Leave your original Mag transfer files on the Mac platform as safety copies.

Logic Audio –Basic Mixing Techniques

This tutorial assumes you have transferred 3 monaural sound files from edited, 16mm mag film with foreground, middle-ground and background sound types and that you are using the DAW for the BEII class in MIT B-65 with the sound cart.

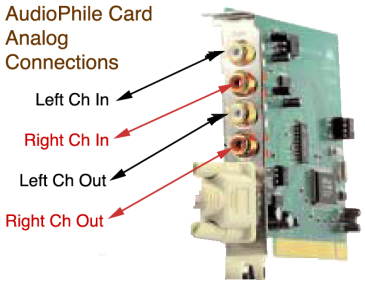
Make this audio patch:



1. Turn on the power to the Fostex Monitor Amplifier. Alternately, you can patch from the DAW output to the Tascam Mixer, plug-in good Sony headphones to Mixer headphone output. Mixing with a speaker is easier if you are just learning.

2. Make sure you are working on the Mac platform equipped with the M-Audio AudioPhile Card.

3. Make sure the audio cables are connected between the Sound Cart and the Mac Computer. Look for the sound card in the rear of the Mac. Four cables should be connected to the RCA connectors as hown here:



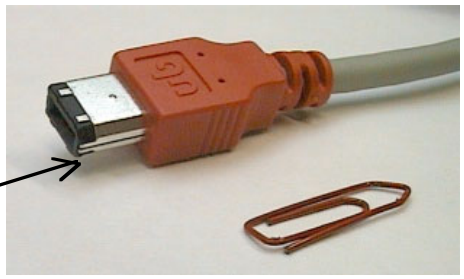
Connecting an External FireWire Drive

4. If your LOGIC Session files are on an external drive, make sure the Mac is OFF. Note: The monitor can be in sleep-dark screen mode but the Mac can still be ON. The computer must be off before connecting or disconnecting an external drive.

Warning

If you forget and hook-up or remove a FireWire external drive to a computer that is already on, do not attempt to mount/re-mount it. Restart the computer and let the drive mount itself as usual. Failing to do so risks serious data loss. The practice of dragging FireWire partitions to the trash and removing the FireWire while the computer is ON is not recommended on the FW drivers that are compatible with many of the older Macs.

5. Carefully connect the FireWire (FW) drive to a FireWire jack on the Mac aligning the curved side when you insert a cable.



Starting the Computer

6. Turn on your FireWire drive first if you are using one. After you hear it spinning at full speed, press the Start key on the Mac keyboard.

7. If you are using an External FW drive, look for it's icon on the desktop. If your FireWire drive does not mount, shut down the Mac and make sure the drive's power is on and the cable is fully inserted at both ends. Restart. If the FW drive still does not mount, scan the bus with DISK WARRIOR and select the drive from the list to mount it. If this doesn't work, get help from the instructor. Disk Warrior is in the Apple Menu.

! ! ! ! ! ! ! Disk Warnings ! ! ! ! ! ! !

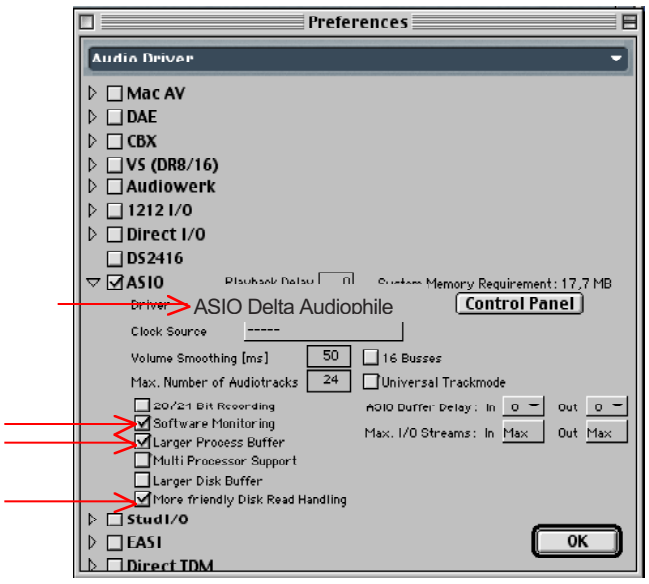
Most serious problems with hard drives stem from two sources: (1) Installation or removal while the computer is running and (2) Failure to complete a writing task due to a "hang" (frozen cursor). The problems created usually surface when starting the computer as (A) a failure to mount or (B) a warning prompt saying the drive is not initialized with an option to INITIALIZE IT. Clicking "OK" to this will cause the data on the drive to become inaccessible! When encountering this prompt, respond "Cancel." Let the boot continue and use DISK WARRIOR to rebuild the disk's directory. If Disk Warrior does not show your drive in its scan, ask the instructor for help.

8. Click on the Doc named,"YrName_Mix" in our project folder. This is a Logic doc with your transfer files already present and your three mag tracks aligned.

Checking Logic Preferences

9. Under Audio->Preferences, where it says, "Recording File Type, "make sure that "SDII" has been selected.

10. Under_>Audio-> Hardware / Audio Driver, in the window that opens, open the ASIO driver window and make sure these selections are made:

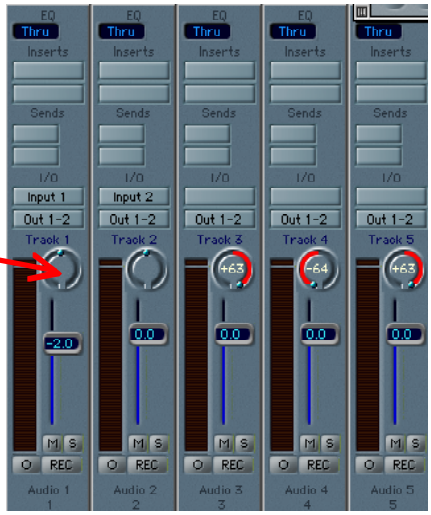


Note: If you do not find the AudioPhile driver listed after “Driver,” select it from the pull-down window. Any time you change the driver, you need to save the Logic session, quit Logic and re-launch it again by double clicking on your Mix session doc again.

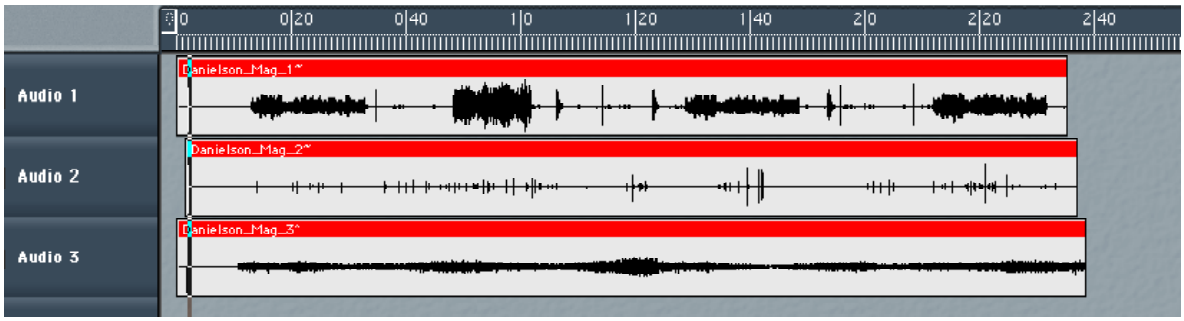
11. Under AUDIO_>Sample Rate, check for 44.1K

12. Check to make sure all Mixer channels are set to centered output: Channels 3, 4 & 5, below, have not been centered yet.

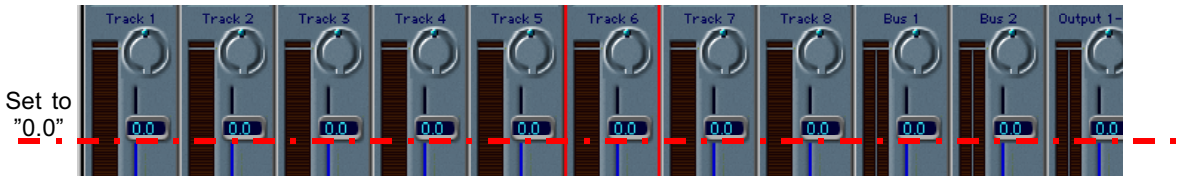
Hold down on the OPTION key and click each of the Pan knobs sending the outputs from each track to Center.



13. If you have not yet placed the three Mag Tracks into the Arrange window as below with the EDIT SYNC FRAMES aligned, do so following the steps in the preceding section.



14. Look at all of the Input channels and the master output channel on the Mixer. Are all of the sliders set at the 0.0dB position? If not, Option-Cick them one at a time and they will snap to into the“0.0dB.”



15. Type RETURN or place the current position indicator to the start of the timeline Arrange window. Press Play (or space bar) and you should be able to hear your Mix.

If No Audio Comes Through

A) Make sure the patch cables connected correctly (see start of this section). Make sure the Fostex Monitor Speaker is on and volume turned up. Make sure you are not playing a section that has no audio.

C) Check the four RCA cables between the Sound Cart and AudioPhile Card

D) Under AUDIO -> Audio Hardware and Drivers: Make sure ASIO AudioPhile driver is checked and the other items are also set correctly. Make any changes necessary, save and quit LOGIC and restart and see if that fixes it.

E) Click in the header area of Track 1, look in the Audio Objects window for Track 1. Is the term “ASIO” under the squiggly waveform icon? If not, click and hold on the other term (i.e. “Mac”) select “ASIO” from the pull down window. Do the same for all of the tracks. Make any changes necessary, save and quit LOGIC and restart .

Setting Mix Reference Level

16. Now that sound is passing through, take a look at the Meter for Master Output 1-2 at the far right of the Mixer Window.

Over-Modulation Light Indicator Box

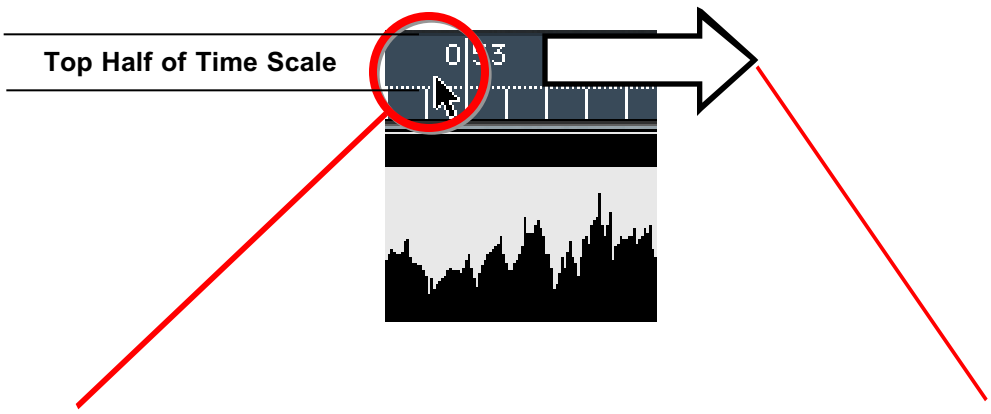
The sound levels in this meter are relative to 100% digital saturation. The loudest moments in your mix should use all of the range without causing the Over-Modulation light to come on.

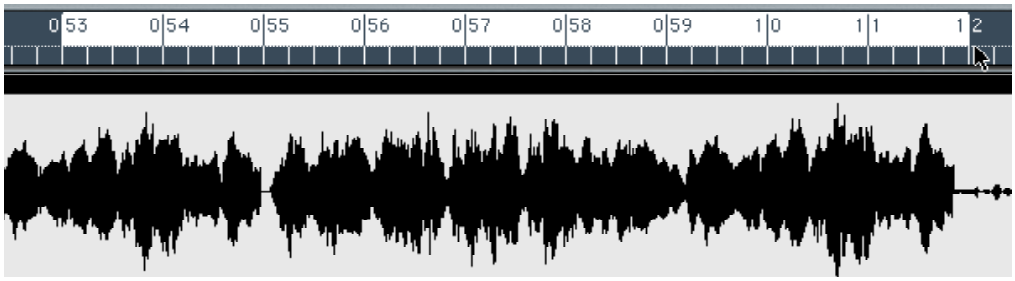
17. Find a moment of loud, foreground sound material in Track 1 that is a good candidate for being the loudest moment (or **Peak**) of the mix. ([It could be the same moment you used to set the record level for the Mag Transfer.] Wer'e going to play this moment in **loop mode** while setting playback levels.

Setting Maximum Playback Level Using Loop Mode

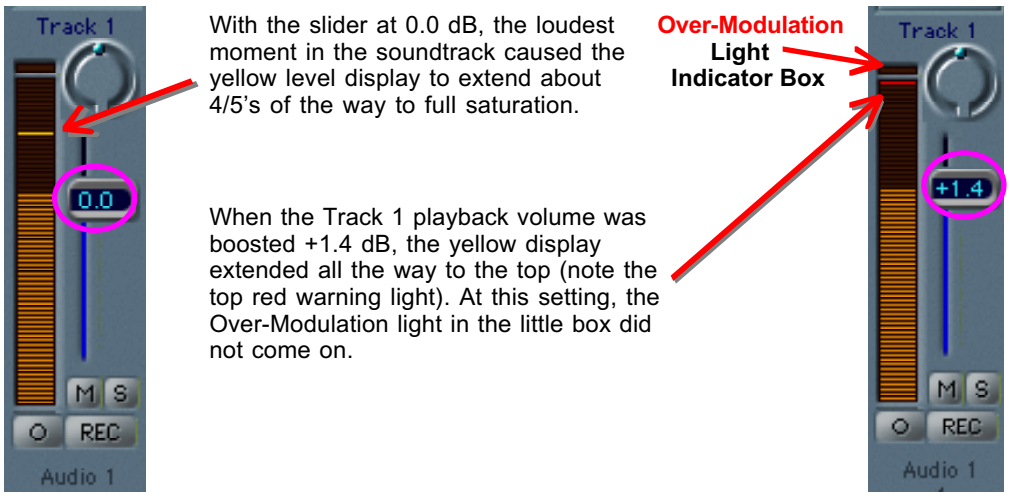
18. Click on the "**S**" (**SOLO)** button for this Track in the Mixer. Adjust the Arrange Window view until you can see the start and the end of the loudest section in Track 1, your foreground material.

19. Click-hold in the **top-half** of the **time line** at the start position and drag (right) to the end of the section with the peak and release the mouse button to set the loop:





20. Press the space bar to start the section playing in Loop Mode. Look at the maximum peak in the Track 1 meter: Let's say the playback level extended about 4/5's of the way to the top. This leaves room for a little "boost" in volume before the "true" peak signal would be running through the system.


Track 1
0.0
M
S
REC
Audio 1
With the slider at 0.0 dB, the loudest moment in the soundtrack caused the yellow level display to extend about 4/5's of the way to full saturation.
When the Track 1 playback volume was boosted +1.4 dB, the yellow display extended all the way to the top (note the top red warning light). At this setting, the Over-Modulation light in the little box did not come on.
Over-Modulation Light Indicator Box
Track 1
+1.4
M
S
REC
Audio 1

21. Set the volume of the monitor level to taste assuming that you are hearing the loudest moment in your soundtrack.

22. With the Ch 1 slide still at 1.4dB, find a section in your soundtrack that is very typical. Put Logic in loop mode playing this segment. Take a seat where you will be as you mix. Is the current speaker playback volume at comfortable level? If it needs to be louder or softer, make the change. Try some different sections. Make a note of the volume knob position on the Fostex Monitor. That is where you need to set and leave the Fostex speaker volume every time you Mix.

23. Click OFF the S or Solo Button in Track 1 of the Mixer.

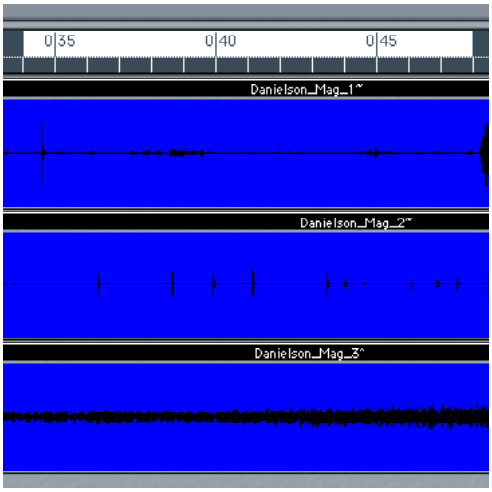
Automating Track Playback Volume

Volume Automation Shortcuts

Turn On Hyper Draw Volume	Click one region or lasso a few regions or All w/Apple-A **+ F1.**
Create a Breakpoint	**Click in region** drag up & down and left & Right. Scale is 0-128. 90= 0dB
Fine Adjust Volume	**Click** on Breakpoint + **Option** Key + Drag Breakpoint Up & Down
Delete a Breakpoint	**Option-Click** on the Breakpoint
Lockout Horizontal	Control + Option or Control + APPLE
Turn Off Automation	**F4**

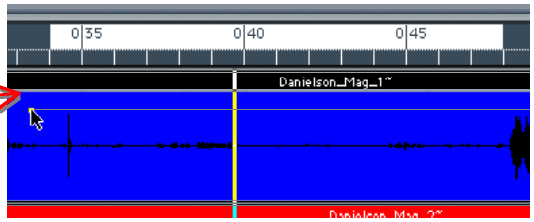
Establishing Space at Select, Softer Passages

24. Make sure the monitor speaker is set at the reference level you determined above. Lasso all three tracks and press F1 to put them all in Hyper Draw volume mode. Pick 1 soft passage in your project where all three tracks provide sound and place in loop playback mode:



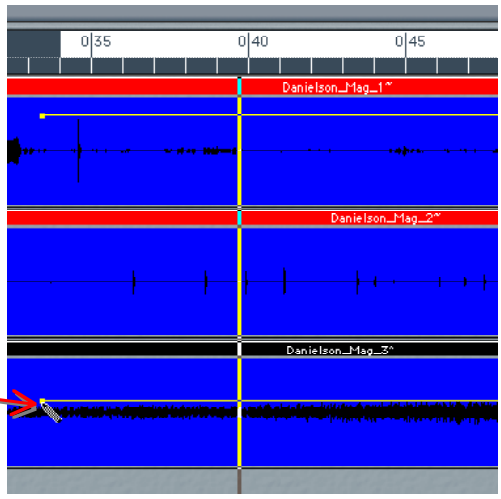
25. Click “S” in Track 1 Mixer to place the foreground track in Solo mode. Click in Track 1 area under the spot where the loop begins to create a volume breakpoint. Drag the point up and down until the playback volume for the foreground elements sound about right. Note:a setting of “90” means no volume change, a value of “128” = +10 dB louder and you can lower the volume with automation all the way down to OFF at “0.”

Ice Groaning sounds about right at a volume setting of 111



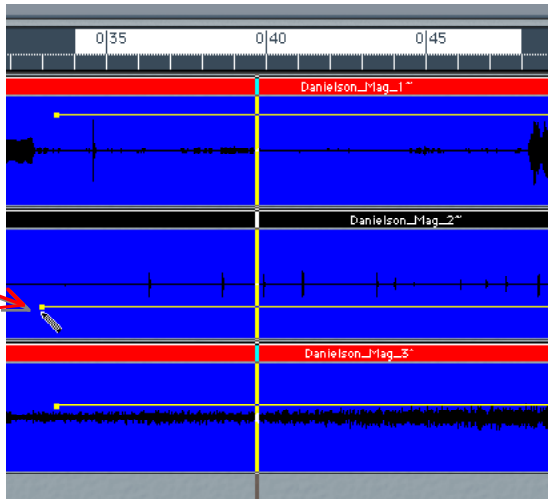
26. Click “S” in Track 3 Mixer to place the Background track in Solo mode too. Click in Track 3 area under the spot where the loop begins to create a volume breakpoint. Drag the point up and down until the playback volume for the Background elements sound about right in relation to the foreground sound. (Try turning the volume off by dragging it to zero and raising it until its barely audible. Its common for beginners to play background Tracks too loud and flatten the space)

Lake Presence sounds about right at a volume setting of 79

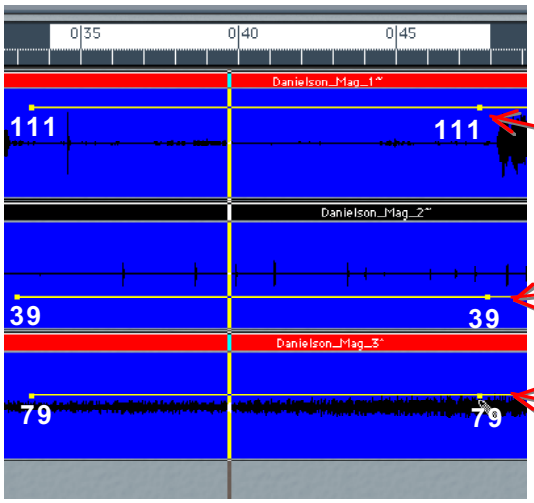


27. Click “S” in Track 2 Mixer to place the Middle-Ground track in Solo mode too. Click in Track 2 area under the spot where the loop begins to create a volume breakpoint. Drag the point up and down until the playback volume for the middle-ground elements sound about right in relation to the foreground and background sounds. (Middle ground sounds should seem to be in the immediate area--,audible above the background yet softer than the foreground sounds).

Wood Chops sound about right at a volume setting of 39



28. To keep these settings for the whole passage, Click again at the end of the passage in each track and drag to match the setting at the start.

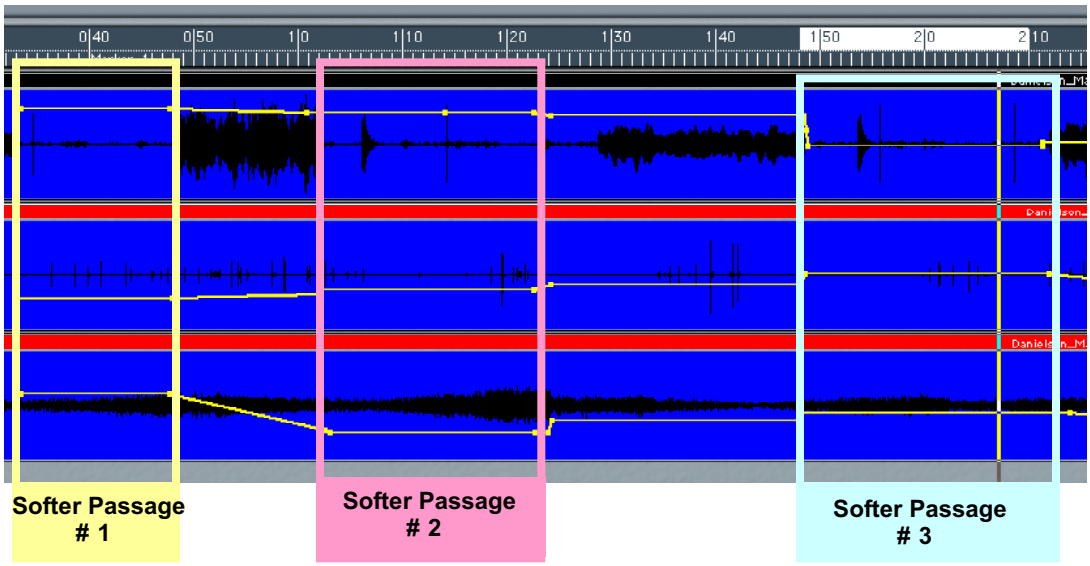


Foreground volume for whole scene is set at 111 with a matched breakpoint on the right.

Middle-Ground volume for whole scene is set at 39 with a matched breakpoint on the right.

Background volume for whole scene is set at 79 with a matched breakpoint on the right.

29. Set the relative volume for all three tracks in the same manner for the other softer scenes in your movie.

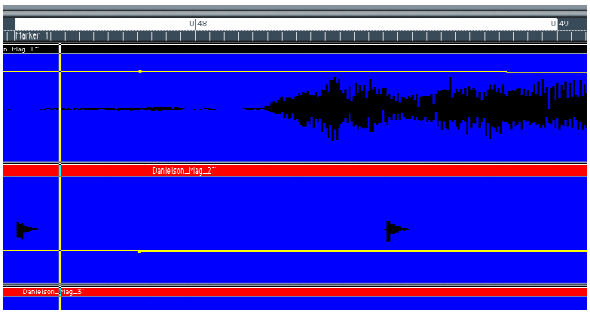


Establishing Space at Remaining Passages

The argument for ***not*** starting form the head and rolling through one scene at a time in order is variety and expressiveness. If you do this there's a strong tendency to not change the settings from scene to scene

The Next step is to adjust the relative volume for the loudest scenes in decreasing order.

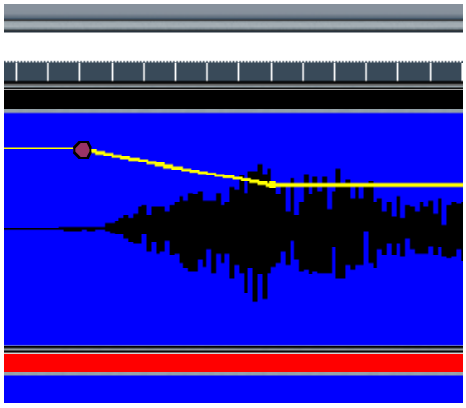
30. Zoom-in at the start of the loudest passage in your soundtrack and place the transition in loop play:



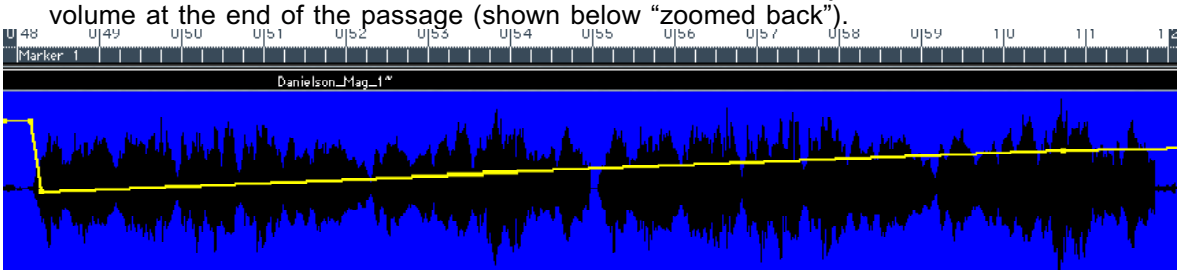
Start of loudest passage

Let's say the transition between the soft passage and the beginning of the loudest passage seemed too abrupt. A lower volume at the head of the passage is desired.

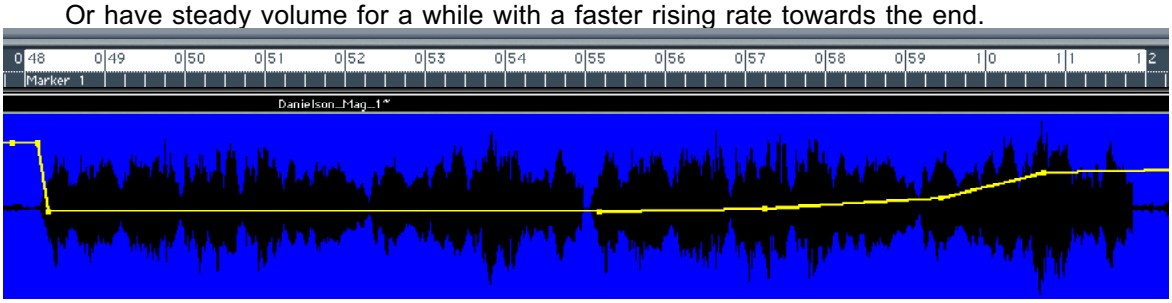
31. First, make a **breakpoint** just before the moment the foreground becomes too loud and try different "slopes" or rates of lowering the volume. At the point the volume seems right, level it out.



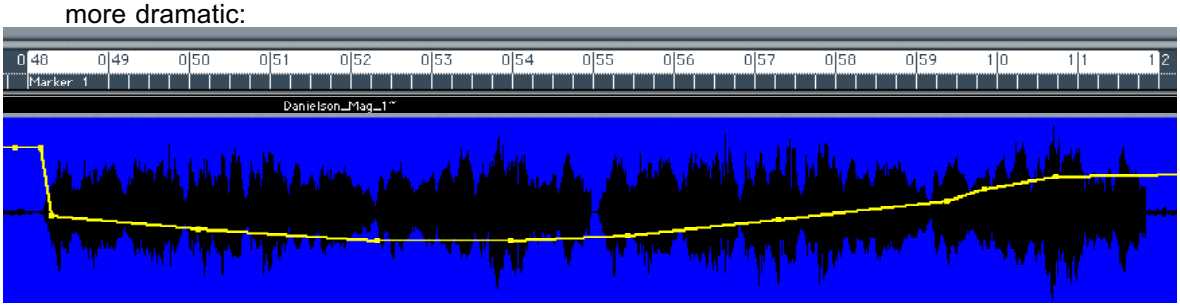
Once the smoother transition is realized, the volume could slowly increase to maximum volume at the end of the passage (shown below "zoomed back").



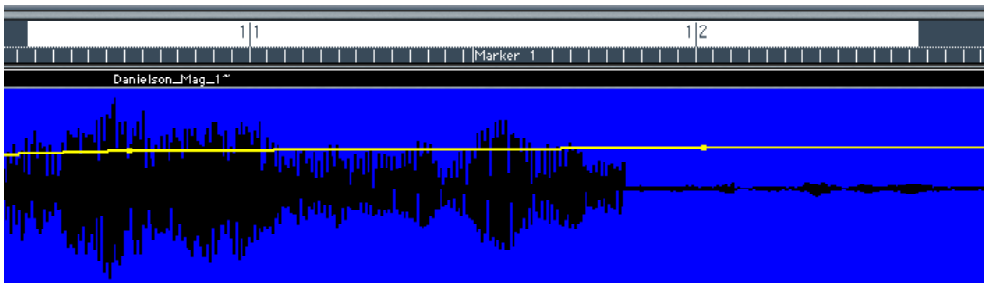
Or have steady volume for a while with a faster rising rate towards the end.



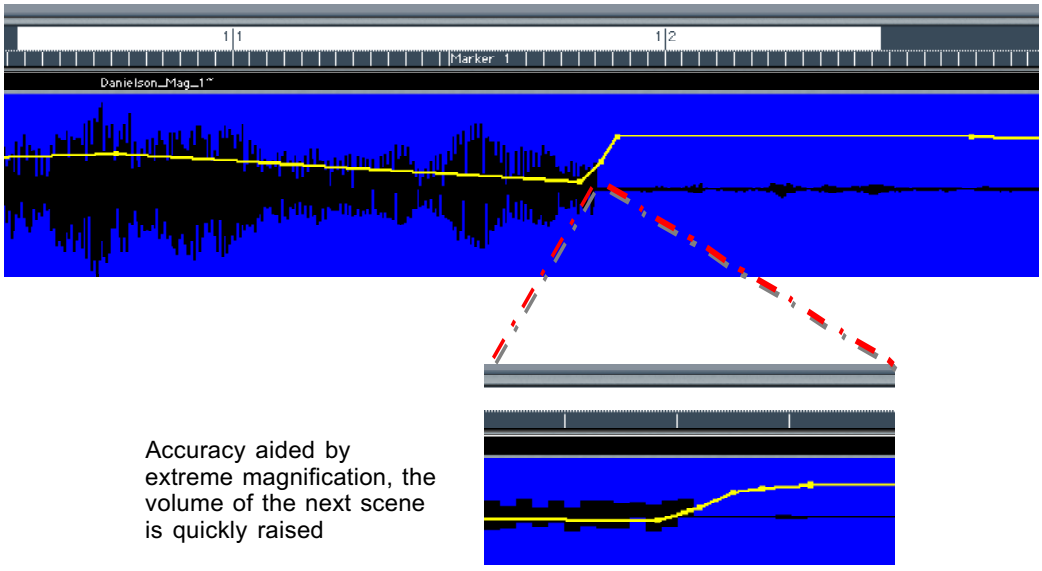
Or possibly with a little softer middle so the rise towards the end will seem even greater and more dramatic:



32. At the end of the loud passage, perhaps the volume seems to drop off too quickly towards the softer passage:



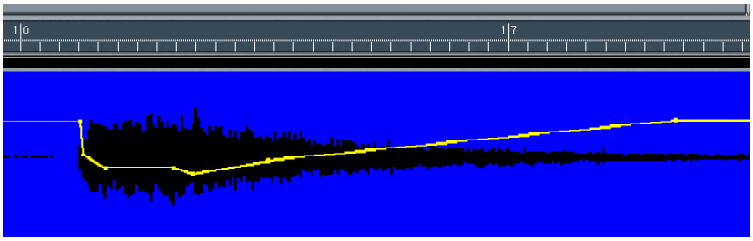
So, automation is drawn to lower the volume after the peak and raise it cross the transition to the softer material. The initial volume of the softer passage is raised and then dropped to the level set for the scene earlier.



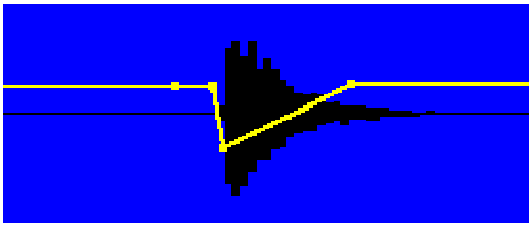
Accuracy aided by extreme magnification, the volume of the next scene is quickly raised

Of course, the backgrounds and middle ground sounds also have to be set for the louder passages as well.

33. Another common need is to lower the volume of a element that has relative slow attack and fade times.

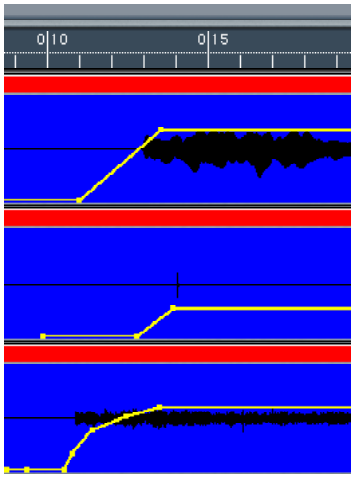


34. Even lowering the volume of very short duration sounds is sometimes possible with some experimentation with the break points under extreme magnification. It can be necessary to create the automation a little before the waveform itself to compensate for computer latency.



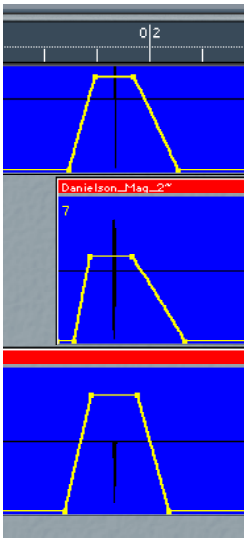
Creating Fades with Volume Automation

Fades at the beginning of a scene or project or at the end are a simple matter of beginning or ending the fade at a setting of “0.” Often, a fade slope with a hump in it (as in track 3 below) will sound smooth than a straight linear fade.



Automating the Volume for the Beep Tones

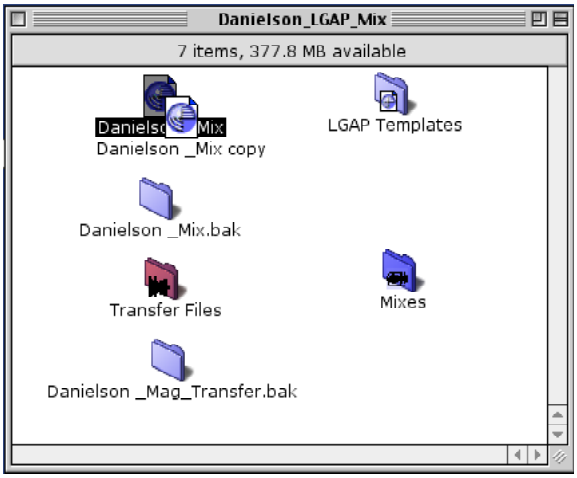
The beep tones at the “2” of the Academy leader and at the Edit Sync will be needed to synchronize the copy of the Mix on Mag film with the edited 16mm picture, so they need to be automated into the mix as well.



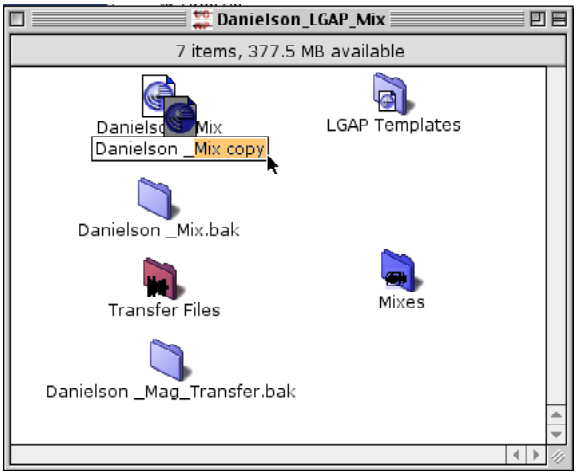
Saving Your Mix Session Doc

In order to prevent losing hours of work, it’s wise to make copies of your mix doc about every 30 minutes or so.

35. Save your Logic Mix Session. Click on your Mix Doc and press APPLE-D to make a duplicate of it.



36. Click once the title bar of the duplicate doc you just made, scroll over the last half of the title and type fresh, unique characters:

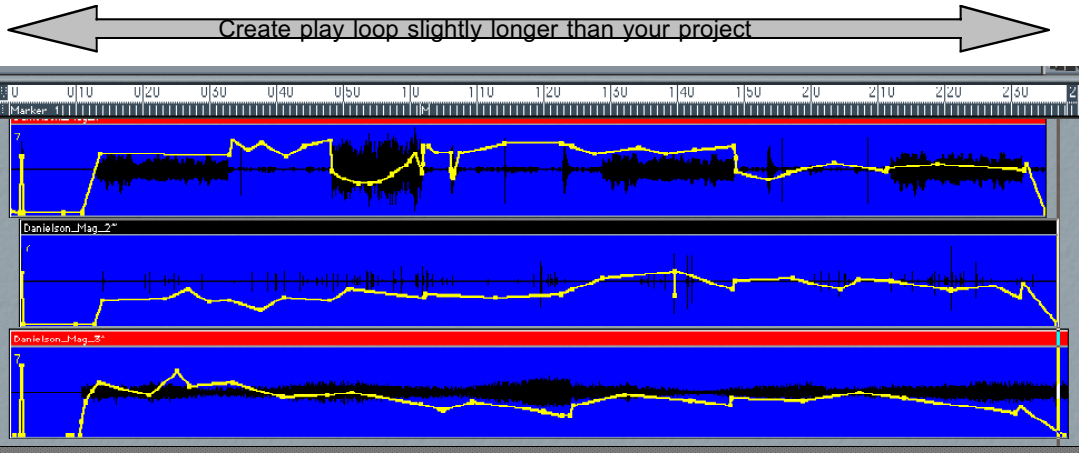


37. Store the duplicate in the back-up folder. (Note you can sort the files by preference of date created if needed to determine the most recent etc.)

Bouncing Your Digital Mix of Your Soundtrack

After the automation has been added to all of the Tracks (**without Over-Modulation**) and you have test played it a couple of times and are close to happy with it, you can output a test mix.

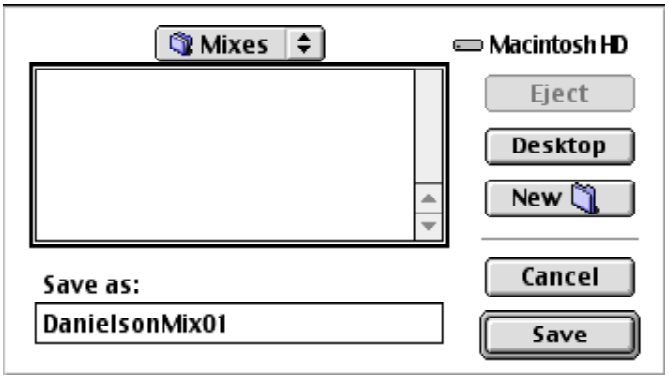
38. Make a loop segment on the timeline for the whole length of your film. Make sure it starts before the first EDIT SYNC Beep and stops after the film is over.



39. Click once on the “Bounce” button by the Master Output Track:

40. In the window that opens up, make sure the below selections are made. Click on BOUNCE.

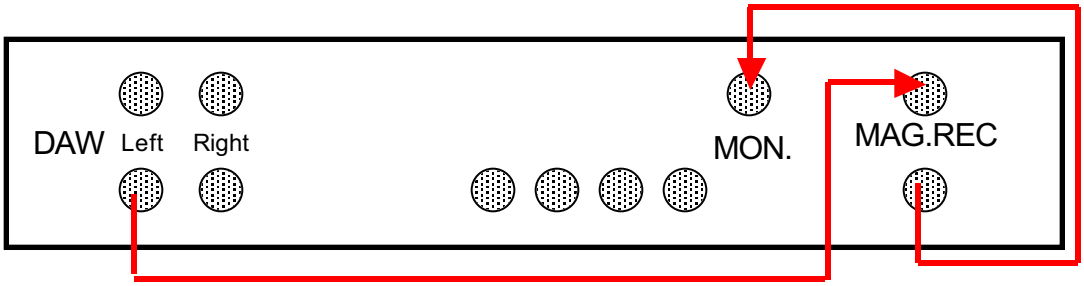
41. Name and navigate so file will be saved in the MIXES folder within your Project Folder:



42. Press on SAVE and Logic will play through your soundtrack in real-time creating the digital sound file.

Transferring Your Digital Mix to 16mm Mag Film

Make this audio patch:



1. Check these buttons on the16mm Mag Recorder Amplifier:
   Black Power Switch On
   Press "**Ready**" and "**Record"** buttons.
   Set Input knob to "4.5"

2. Load Mag stock on 16mm Mag Recorder (best to bulk erase before)

3. Turn on the power to the Monitor Amp.

4. Make sure you are working on the Mac platform equipped with the M-Audio AudioPhile Card.

5. Make sure the audio cables are connected between the Sound Cart and the Mac Computer. Look for sound card in the rear of the Mac. There should be four cables connected to the RCA connectors on the audio card going to the cart.

Transferring Mixes Done on Out of House Computers

Although you are required to cut three tracks of 16mm MAG sound (background, middle-ground and foreground) to use as the basis of your soundtrack, you may take the digital files made from these edited Tracks to mix on your own computer system. If you take care to not move the regions in relation to each other, "sync" between picture and sound will remain perfect.

For **PC compatibility**, there are several issues:

Sound file formats:
PC systems need to set to output .**Wav** format files (or AIFF)

Transporting PC Generated Media to UWM:
It is recommended that you make a copy on both a **100mb Zip** disk and an **ISO 9660 format CD-R.** For the later, look at the preference setting in your PC C-DR burner program for this format or the one specified as having Mac compatibility. Failing this, burn the audio to an AUDIO CD. Do not assume because you could load a digital sound file onto a Zip Disk from your PC at home that the disk will be "seen" by the Mac in B-65. Do a test and bring the disk to B-65 to see if it works. If it does not, format the Zip Disk on the Mac B-65 and see if it will mount on your PC. Another alternative is to do the transfer from a PC laptop with audio output capabilities. Make sure you have your own connector wires for this. The patch bay needs a 1/4" monaural input.

For Mac **compatibility**:

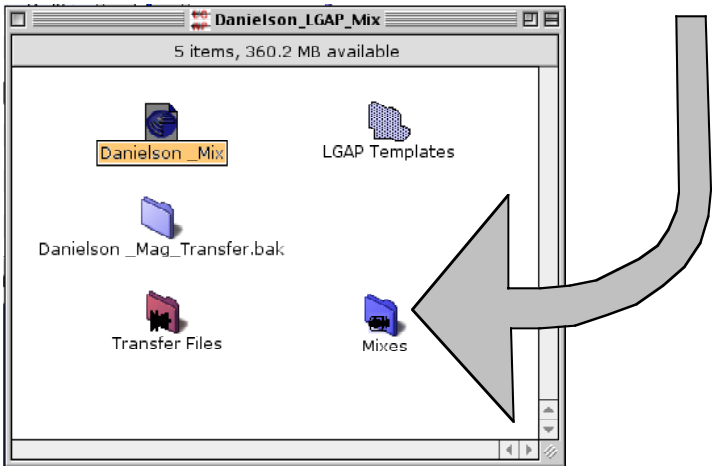
Mac systems need to be set to output **.AIFF** or **SDII** (Sound Designer II).

Transporting Mac Generated Media to UWM:
It is recommended that you make a copy on both a **100mb Zip** disk and a Mac format **Data CD-R.**. Failing this, burn the audio to an AUDIO CD. Do not assume because you could load a digital sound file onto a Zip Disk from your Mac at home that the disk will be "seen" by the Mac in B-65. Do a test and bring the disk to B-65 to see if it works. If it does not, format the Zip Disk on the Mac B-65 and see if it will mount on your Mac.

Starting the Computer

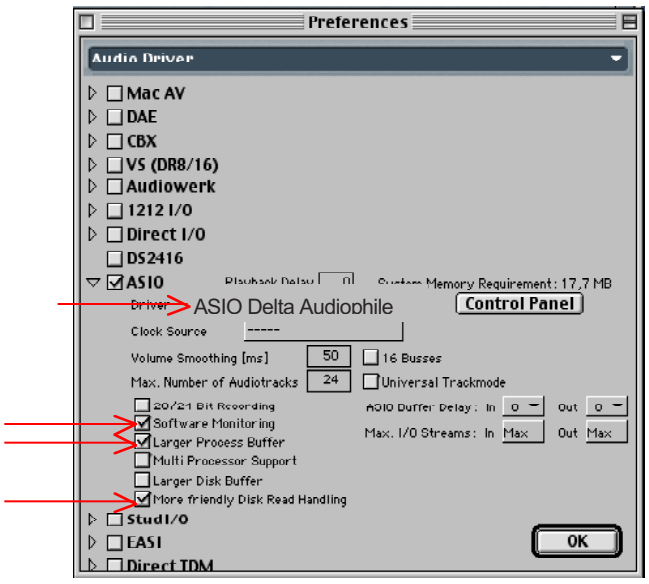
6. Turn on your FireWire drive first if you are using one. After you hear it spinning at full speed, press the Start key on the Mac keyboard.

7. If it is not already located there, copy your mix to the Mixes folder in your projector folder.,



8. Double-click on the title bar of the LOGIC doc named, "YrNameTransfer_or_Mix" to launch LOGIC. Check the preferences as follow:

9. Under_>Audio-> Hardware / Audio Driver, in the window that opens, open the ASIO driver window and make sure these selections are made:

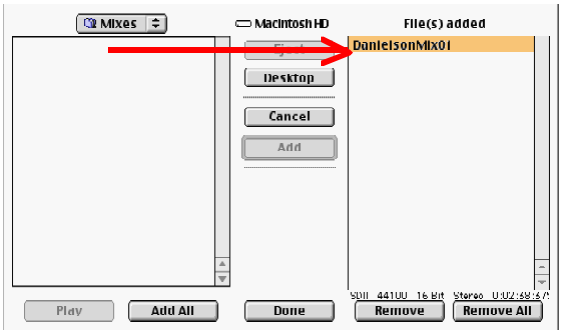


Note: If you do not find the AudioPhile driver listed after “Driver,” select it from the pull-down window. Any time you change the driver, you need to save the Logic session, quit Logic and re-launch it again. Relaunch by double clicking on the ”YrNameTransfer_or_Mix” doc.

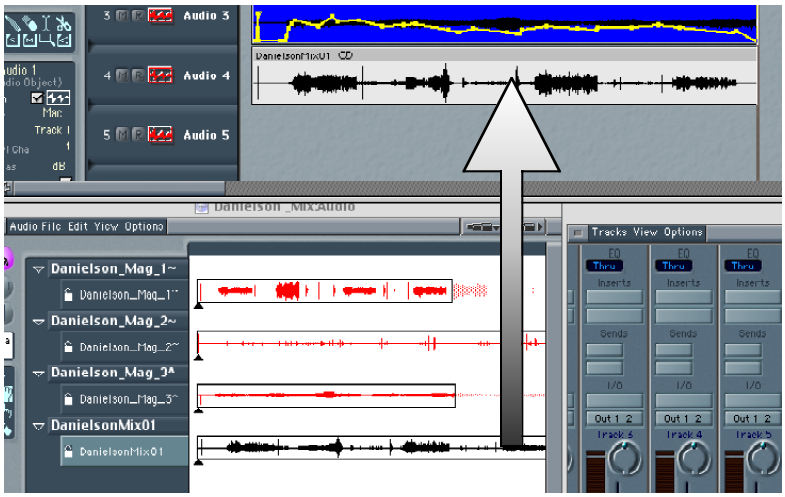
10. Under AUDIO_>Sample Rate, check for 44.1K

Importing your Mix into Your LOGIC Session

11. In the Audio Window-> AudioFile-> select Add Audio File. In the window that opens, navigate to your Mixes folder in the left column and click ADD to import your mix to your LOGIC Session (right column) and click Done.



12. The mix should now appear in your Audio Window. Click and drag it into Track 4 of your Arrange window session aligning it underneath the other tracks.



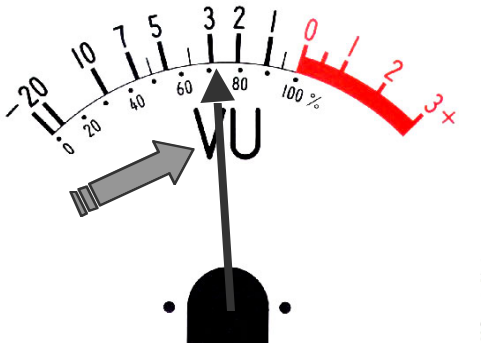
Slip the mix into an open Track underneath your MAG Tracks and line-up the Edit Sync Beep frames. Go to percussive events towards the end of the mix to confirm that they line-up with the same moments in the Mag transfers. If they don't, you can either re-edit your Mix or make a few splices in your MIX sound file to make it sync-up.

Retransferring the Mix to 16mm Mag Film

13. Option-Click on the Output slider for Track 4 (or the track your Mix is on) so that it's set to "0.0"dB. Select "S" to put that track in Solo mode. Make sure no other tracks are also in SOLO mode. Option-Click the Output Master 1-2 slider so that it's set to "0.0"dB.

14. Set Track 4 playing in Loop Mode. You should be able to hear the mix through the Fostex Monitor Speaker. If not and you can see levels in the Logic Meters, check the audio cable connections. If you cannot see audio in the LOGIC meters, check your mixer window settings. If these are right, click on the header for Track 4 and look at the Audio Driver selection for Track 4 in the Arrange Window. It should show "ASIO" as below. If not, stop your session, click-hold on "Mac" or other incorrect term and select ASIO from the pull-down menu. Save your Logic Session. Quit Logic and Re-launch Logic and continue.

15. In solo mode with output levels set to unity (0.0dB), the record level in the MAG Deck VU meter should go to –3 dB at the loudest moment in your Mix. If the meter exceeds this, reduce the record knob on the MAG Deck below 4.5 until it does. If the loudest moment on your Max makes the Mag Deck VU meter fall short of –3dB, turn the knob above 4.5. If you have to turn the Record Level knob above 8, your digital mix sound file is probably too low, try boosting the Mixer Track 4 slider in Logic about to see if you can get adequate output for running the MAG DECK record level knob closer to 4.5. After setting the Mag Deck record Level so the peak in your Mix make the VU meter extend to –3dB, you are ready to make the transfer to 16mm Mag Film.



Loudest moments in your mix should make the Mag Recorder Vu needle extend no further than –3 Vu.

16. Click on the white loop marker in the Arrange Window timeline to defeat Loop Playback mode. Place the current position marker before the Edit Sync Beep in the Arrange Window. Start the Mag Deck rolling in Record Mode. As soon as the speed of the Mag Deck stabilizes, press the space bar to start the Mix playing in LOGIC. Let the Mix roll all the way through and stop the Mag Deck. Before disconnecting your Mac to Mag Recorder re-transfer set-up, take the mag mix to a Steenbeck with your edited picture roll and confirm that the recording is good and that the mix syncs up.

17. Save your Logic Session. Drag copy your entire LOGIC Session Folder with all files to a Zip Disk so that you can continue working on your soundtrack at a later date if you wish.

Congratulations on your first Film Soundtrack!

Designing Interview Questions

Note: The following suggestions apply to the program style where the interviewer's voice will not be included in the final edit.

1. **Your Angle.** *This step is based on the main question you are exploring which you should have already stated for yourself in writing.* To develop your angle**,** start-off by defining the topic, issue, curiosity, etc. in one descriptive statement that has key nouns and the right tone. Imagine saying the sentence to someone who asks what you're doing. For example, "I'm making a film about the things people think about when they walk through a neighborhood that is quite different from the one they grew up in." It should account for who is involved, where it happens and what you are trying to learn about. An angle should take into consideration popular preconceptions about the topic, issue or situation into consideration and go beyond them. For the above the preconception might be: "One takes much higher risks when walking in certain neighborhoods."

2. **Opening Questions.** Until the interviewee is comfortable with you and what you are asking, she or he will prefer to speak in general impressions and opinions. You can avoid some this by giving your first question a specific, personal context like: "There is a popular preconception that one is taking much greater risks when walking down a street like this one. What do you think? or "My older neighbor, Frances Wilde, says she is very afraid walk to walk down the street where we live. What are your thoughts about an older person's safety on this block? or "I have this sense that, at times, it could be quite dangerous for me to walk down this street. Am I right in these suspicions?" Try to guess how people will respond to the different ways you can frame your first question. Try them on your self and your friends. Is the question clearly worded? Is it interesting to think about? If they find your question interesting to try to answer, its probably a good one. If you or they can give a quick, obvious answer, more thought about actual human experiences involved will probably help.

3. **Locating Influences.** Often the first responses one receives are often so general and brief that you get stumped. In this case you can always ask about specific examples to illustrate their viewpoint or opinion etc. You have to be careful to not formulate an intimidating "why" question that is equally difficult to answer. Practice and have ready your own personal version of a response/question that encourages specific influences without suggesting sources like: "That's understandable; you must have a variety of reasons for saying that. Is this an opinion you've formed recently?" There are experiences behind all opinions-- this is what you want them to talk about.

4. **Encouraging Descriptions.** Useful material often surfaces when the interviewee is encouraged to talk carefully about a specific experience in the past. Stories are the way humans combine experience, emotion and insight to convey values without being overly-authoritarian. Interview questions including words like, "Where," "When," "What," or "How," encourage specifics. Develop a few open-ended questions you can adapt to the situation like, "How can you tell when...?" "What impact did it have on you when...?" "Can you recall the place where...?" Avoid questions starting with "Did" or "Do" at this stage in the interview because they can usually be answered with a simple, "Yes" or "No. To prepare for these questions, imagine a life situation that an interviewee might allude to and draft questions to draw out longer, detailed descriptions of the experience.

5. **Warm-Ups.** Finally, it can help to draft a few comment/questions to use while you're setting-up your equipment or when you sense that the interviewee is nervous. Think of aspects you share like, "This is the first time I've done an interview like this, what about you?" You can also describe aspects of your project that they might be curious about like how long you've been working on it, other persons you'll be talking with. Some honest thinking in advance can help you avoid an awkward interview.

Glossary of Image, Sound & Other Useful Terms

Acceleration When an object or camera movement appears to be changing speed-- speeding-up or slowing down. In film editing, cuts are often made at moments of perceived acceleration taking advantage of the momentum created. The kinetic energy seems to flow across the cut.

Amplifier The electronic device that controls the loudness of the sound through speaker system during audio playback.

Amplitude A term for loudness or volume in electronics. An audio signal with high amplitude is relatively loud; a audio signal with lower amplitude is softer in volume.

Ambience The atmospheric sounds of a location usually created by many sound sources like automobile traffic or insects at a distance. Sometimes less pleasant actual sounds are idealized by sustained strains in a musical score.

Analog Audio The older but still widely used kind of audio system in which reproduction is realized through voltage variations in continuous time. Better analog recording systems exceed the abilities of common playback settings like television and radio.

Anecdote A brief story to illustrate a point.

Art The ability of perceptual objects or actions, either natural or man-made, to represent, through their appearance, constellations of forces that reflect relevant aspects of human experience. (Rudolf Arnheim)

Background Music Music used behind other sound elements at a volume that permits the other sounds like voice or locational ambience to be easily discerned simultaneously. Background music is frequently used as a background sound element.

Background Sounds In soundtrack space, the least loud element(s). These low-volume sounds are often continuous (sustained) and have emphasized lower tones. Though subtle, they can be very instrumental in supporting a mood in the soundtrack.

Balanced Composition A more restful configuration of pictorial elements in which the internal forces compensate for one another. The mutual neutralization of directed tensions create an effect of immobility at the balancing center.

Bass A term borrowed from low tone musical sound sources used generally to describe the lowest portion of the audio spectrum. On stereos, boom-boxes and the like, the knob labeled "bass" affects the loudness of the low frequency range tones.

Composition An arrangement of visual elements creating the impression of a self-contained, balanced whole. which is structured in such a way that the configuration of forces.

Continuity Editing An assembly of shots that attempt to maintain "realistic" space and time.

Depth of Field The depth ,in space, in front of the camera lens in which objects are rendered with equal sharpness. A function of the focal length of the lens, the focus setting and the F-Stop setting.

Camera Attitude The relative view of the subject created by camera/subject heights.

Eye Level Achieved when the lens of the camera is at the same height above the floor as the eyes of the subject. Lends a shot a sense of equality and intimacy.

High Angle Achieved when the lens of the camera is higher than the eyes of the subject. Lends a shot a sense of mild to significant superiority depending on the difference in height.

Low Angle Achieved when the lens of the camera is lower than the eyes of the subject. Lends a shot a sense of mild to significant inferiority depending on the difference in height.

Camera Movement

Dolly Movement of the camera towards or away from the subject. (I.e. "dolly-in", "dolly out")

Pan Pivotal, horizontal movement of the camera on a tripod or hand-held.

Tilt Pivotal, vertical movement of the camera on a tripod or hand-held.

Track Movement of the camera along a line that is roughly perpendicular to the subject. (I.e. "track left," "track right")

Orbit Movement of the camera around the subject, usually hand-held.

Center Frame An approximate location in the middle of the rectangle frame equal distance from the sides and top/bottom.

Channel/Track In audio systems, the location where the separate parts (or elements) of a an audio recording are stored. Stereo recordings, for example, have two channels which are stored on two separate tracks.

Cinema Veritè **"**Cinema Truth" in French. A low profile documentary-style production where there is little or no directing of any of the activity before the camera. Usually attempted with a light-weight equipment and a very small crew or one camera person. The "truth" is that the camera is just observing/listening to what is happening.

Close-Micing A technique of placing the microphone very close to the source of the sound to achieve more "warmth" and a sense of intimacy. Very common for voice-over narration and other dubbed voices.

Color Saturation The intensity of the colors on the screen.

Color Palette The selection of colors in a shot.

Content The ideas and emotions involved with making and viewing a representation. These can be different and still be content.

Context The circumstances surrounding any part.

Contrast The play between dark & light in a photographic image

High Contrast Detectable by the stark presence of mostly dark "blacks" and bright "whites" in an image. There is considerable "push/pull" between the figure and ground with high contrast images.

Low Contrast Detectable by the presence of many middle shades of gray in the an image. Low contrast images are often described as "flat."

Medium Contrast Detectable by the stark presence of several shades of gray between the "blacks" and "whites" of an image. Objects are rendered with enough gradation to have volume with little push/pull effect.

Cooperative Distribution A means of sharing the costs of distribution between many film or video makers. There are several such organizations in the U.S.

Cut (Straight-Cut) The simplest of all transitions. In film, two shots are spliced together so that the change from one shot to the next occurs instantly. The splice is done through re-recording in video and the effect is the same. The vast majority of transitions in most programs are straight cuts.

Cutaway A picture-only edit to material that has just been anticipated or referenced

Decibel A unit used in measuring the relative loudnesses between two sounds.

Diagetic (On-Screen) Sound Sound elements that the viewer can associate with on-screen objects, persons, etc. These sound elements are not necessarily "original recordings" as they still called diagetic even when added or modified later in production.

Dialogue Conversational speech as recorded sound element.

Digital Audio A newer audio system in which reproduction is realized through "sampling" audio signal voltage conditions at very brief periods of time and converting (quantizing) the results to a numerical value. Digital audio can provide greater fidelity but it requires elaborate playback systems for the listener to discern the improvements.

Dissolve A transition between two shots in which two shots appear to momentarily "melt" together. Also called a "lap dissolve," it is created by having the first shot fade out as the second shot fades in. Dissolves in films range from about 1/2 second to about 3 seconds. In video they range from a frame or two up to several seconds.

Distortion Often a "crackling" deterioration of the sound quality that is audible when the recordist allows the intensity of the audio signal to exceed the highest limits of the recording system.

Distribution The efforts associated with getting the film or videotape shown after it is complete.

Dubbing In popular usage, the act of substituting another sound recording so it can seem to be the original recording. Dubbing has become a very common practice in commercial contexts. Soundtracks for feature films and advertisements, for example, are often concocted entirely from "dubbed" elements including voice, effects and background ambience. In this case, the original sound recordings are used for timing reference only. See Foley below. (In production contexts, dubbing refers to the simple act of making a duplication of a magnetic recording).

Dynamic Range The range between the quietest possible sounds in a recording and the loudest possible sounds. This range is a function of the recording system. Better Analog systems have a range of about 60 decibels while digital systems have a much wider range of around 90 decibels. However, everyday audio playback systems like television and radio have an effective range of around 40 decibels.

Effects In sound production, effects are often short duration (percussive), higher frequency sound elements that are located in the middle plane (middle volume) in soundtrack space. Most effects are subtle, incidental sounds like clicks, taps, scrapes, etc. which can be from on or off-screen sources.

Equalization The process of altering the tonality of sound through adjusting the loudness at one or more points along the audio frequency spectrum.

Experimental Film A film which explores through experimentation how filmic representation works. To do so, experimental works often address basic mysteries as how consciousness is constructed through sense and experience.

Eye Movement In film and video, the movement of a viewers eyes as he/she watches a shot or program. This activity is of interest during film/video editing as it can be predicted enough to affect program rhythm and which portions of the screened image(s) will be perceived depending on shot length. A key principle of eye movement is that when presented with a new scene, the eye is always pulled initially to brightest area of the screen. Moving objects also receive greater initial attention.

Fade In audio production, the lowering or raising of the volume of an element in a soundtrack. In addition to a change in volume of the whole soundtrack, elements within a soundtrack are frequently faded. A sound element that "fades-in" rises to

audibility within the volumes of the other elements; one that "fades-out" sinks to inaudibility within the existing volumes.

Fade In image production, a very common transition with two variations. A **fade-in** creates the impression of a scene emerging from darkness. A **fade-out** creates the impression of a shot or scene falling into darkness. They are used often to mark the beginnings and endings of sequences in a program.

Figure & Ground The distinction between perceptual objects and the space surrounding them. A figure is generally observed as lying in front of an uninterrupted ground- the most elementary representation of depth in drawing and painting. (Rudolf Arnhiem) The figure plane is often considered to be positive and the area(s) surrounding the figure to be "negative space(s)" as there is usually a difference in tonality between the figure and the ground.

Film/Video Frame The smallest unit of image in serial image systems. In film, frames are projected at the rate of 24/second, sound speed. In video, frames are scanned at the rate of 30/second and each video frame is actually comprised of two video "fields." The term, "still" from is a photographic print made from one frame of film or one field or frame of video.

Foley A term derived from the name of an artist who developed an uncanny ability to simulate a wide variety of sounds with assorted object, body and mouth sounds. "Foley" performances are recorded and edited-into (dubbed) soundtracks in synchronization with on-screen events.

Foreground Sounds In soundtrack space, the loudest element(s). Because foreground sounds usually lead the attention of the viewer, they work best when they have interesting sonic qualities. Voice and tonally complex effects with considerable variation in amplitude (volume) and tonality (frequency) are most common.

Foreground/Background Related to the perception of figure/ground, but a specific awareness about video images recognizing that the depth of pictorial space is often reduced to only two planes. With video camera generated images, detail is much more evident in foreground objects.

Form The materiality of a representation including all of the qualities of those materials.

Format The shape a presented picture. For rectangular pictures, the ration between the height and the width. In motion picture film and NTSC video, 3 units high by 4 units wide.

Freeze Frame A printing technique that allows one film frame to remain on the screen for a longer period of time. A similar effect can be achieved with video.

Frequencies Sound is created when an object vibrates. The vibration rates (frequencies) determine the tonalities produced and most sounds contain several frequencies. Human ears can detect frequencies from 20-20,000 cycles per second. Lower vibration rates create low pitched tones and higher vibration rates create high pitched tones.

Frequency Range The range of tones (frequencies) produced by a sound source or reproduced by a sound system. Three regions of the range commonly referred to are: Low (20-250 Hz) Middle (250- 4,000 Hz) and High (4,000 -20,000 Hz).

Gaze/Look A pictorial force created by the direction that a subject is looking in a film or video image.

Gestalt The immediate impact of an image on the eyes. As defined by Rudolf Arnheim: "A field whose forces are organized in a self-contained, balanced whole. In a gestalt, components interact to such an extent that changes in the whole influence the nature of the parts, and vice versa."

Grain The visual texture of the projected image that can be attributed to the size of the light absorbing particles of the filmstock. This texture changes with type of filmstock and the number of times the image has been copied (generations). Video also has a texture but its referred to as "noise."

Hand-held Camera The act of holding and moving with a light weight camera during the act of filming or videotaping can create a great variety of movements and a surprising range of psychological implications. As a rule, the organic qualities of the movement-- the circularity, slight shaking and hovering connote greater subjectivity or more involvement in the act of filming.

Hertz (Hz) A unit of measure of frequency. Same as cycles per second or (cps).

Highlight Details In black & white film, those parts of the projected image that are visible in the lightest areas.

High Frequencies In the audio frequency range, those from around 4,000 Hz to 20,000. These frequencies add clarity to recordings. Some common sounds with pronounced high frequencies are: consonant sounds of human speech, sizzling, rain and cymbal percussion.

Illusion of Movement Movement in a film or video is an illusion created by the viewer as she/he fills-in the gaps between motionless frames. This ability apparently stems from the *persistence of vision* effect in the eyeballs and the *Exiter Effect* in the brain.

Imbalanced Composition A composition in which one side or edge of the frame seems weighted or incomplete creating a feeling of transition for the viewer. Imbalanced compositions are more common with moving images than with paintings or photographs because there are ways to incorporate this dynamic through editing.

Independent Film A film made with a modest budget and free of commercial obligations.

Jump Cut A moment of discontinuity (jump) in the picture due to a splice made when removing a portion of the sound. (Picture frames were removed to maintain sync but the audio splice is usually inaudible). Often jump cuts are "covered-up" by cutaways. Once considered annoying, jump cuts are created for effect today.

Locational Sound Called "Nat (Natural) Sound" by videographers and locational sound by film recordists, these recordings can be of the background or middle-ground type depending on the micing distance from the sound source(s). (Greater distance = more background). locational sounds are often used at a low volume to contribute realistic texture behind voice or mixed with music or middle-ground effects.

Loudness The subjective perception of amplitude or volume.

Low Frequencies In the audio frequency range, those from around 20 Hz to 250 Hz. These frequencies add bass warmth to recordings. Some common sounds with pronounced low frequencies are: traffic and machinery "rumble," bass musical instruments and the lowest tones produced by the human voice.

Medium Any artificial, material means of extending a human capability.

Microphone A device that converts air vibrations into electrical impulses at the input or beginning of the recording system.

Middle-Ground Sounds In soundtrack space, element(s) whose loudness is less than that of foreground sounds but more than that of background sounds. Subtle percussive sounds with pronounced high frequencies are common to this plane.

Mid-Frequencies The part of the frequency range from 250 Hz to 4,000 Hz. Most of the sound that we hear comes from this portion of the audible range but if a soundtrack has only mid-frequencies it will lack warmth (low frequencies) and clarity (high frequencies).

Mixing The process of combining several sound elements often from different tracks during re-recording. The "space" of the soundtrack is achieved through establishing different volume levels for the elements.

Montage The juxtaposition of two or more images of separate events that when shown together create a larger, more intense whole. (Herbert Zettl)

Multi-Track Recording Systems Those which utilize separately recorded and edited sound elements on different tracks or channels for greater flexibility in creating soundtrack or music space. These systems are in common use today even in lower-cost music and media productions.

Narration From the Latin word, "to tell," a close-mic'd voice recording in the foreground plane directing the attention of the viewer with language and musical qualities of speech. The voice of a narrator can be included with or without an on-screen appearance. See Voice-Over.

Narrative Any style which tells a story. This term that is not limited to theatrical or dramatic works as experimental, documentary and abstract styles can also tell a story.

Negative Image An image in which the tones are reversed. What would normally appear white is black and vice versa.

Off-Screen Space The imaginable space beyond the borders of the screen. Used in reference to objects, persons, events, sounds, etc. that can be imagined by the viewer as contiguous with "screen space"-- the part of space that can be seen.

Off-Screen Sound Related to off-screen space, sound elements that can be associated as coming from the space outside of the visible limits of the film rectangle or video screen. Non diagetic sound elements.

Optical Printer The motion picture machine used to create optical effects such as freeze frames, bi-packs, matte-shots and others. It allows the re-photographing and manipulation of existing film images one frame at a time.

Pitch The subjective perception of frequency.

P.O.V. (Point Of View) A shot the portrays the vision or viewpoint of a particular person.

Post-Production The stages of making a film or video after the photography or videography stage is complete-- principally involving the logging, edit-planning, editing and final sound mix.

Presence Track A locational recording of only the background sound that is used to fill-in the gaps created by edits in the foreground elements recorded in the same location. For interior locations, the presence is sometimes called, "room tone."

Projection Range A portion of the audio frequency range from around 1600 Hz to 2500 Hz which has a substantial affect on the apparent loudness of a sound. Human ears seem to be are more sensitive to frequencies in this range and there is a pronounced "tinniness" that can fatigue the listener with prolonged exposure. Bull-horn and many public address speakers emphasize the projection range frequencies for greater efficiency.

Process Activities scripted into a shot to add movement and expectancy.

Production Phases

Pre-Production The phase of making a film or videotape when the conceptualizing and planning is done.

Production. The phase of making a film or videotape when the filming or videotaping is done.

Post-Production The phase of making a film or videotape when the logging, edit scripting, editing, sound-cutting and sound-mixing is done.

Program A representation with a fixed, timed duration.

Recorder A device responsible for creating impressions that can be retrieved at a later time.

Resonance A phenomenon of one object being vibrated by the sound vibrations transmitted from another object. For this to happen the "natural" frequencies of both objects must be similar.

Reverberation The audible effect of a sound reflections from nearby surfaces adding an subtle echo-like quality to the sound. Reverberation gives the listener cues about the physical surroundings but can also significantly deteriorate clarity when the middle-range frequencies are over-emphasized. Audio engineers call recordings with pronounced reverberation, "wet" and since reverberation can be easily be more easily controlled electronically in post-production, the trend is to make the original recordings "dry" with as little reverberation as possible.

Scene From dramatic-narrative style, a collection of shots constituting a span of time in one place. In other styles, a section of the program with like material.

Screen Text Words printed on the screen in a variety of ways from subtitles to credits.

Sequence A section in a program, often a collection of related scenes.

Shadow Detail In black & white film, those parts of the projected image that are visible in the darker areas.

Shot The film or video tape material created from the moment the camera/recorder was started until it was stopped. In an edited program, the part of the original shot included.

Shot/Framing

Long Shot In exteriors, framed so a large area or part of the area is visible. In interior locations, whole bodies are visible.

Medium Shot Framed so bodies are visible from the knees up.

Medium Close-Up Shot Framed so the body is visible from the chest up.

Close-Up Shot Framed so the body is visible from the tops of the shoulders up.

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Extreme Close-Up Shot Framed so a body is visible from the neck/chin area and cropped at the top in the forehead area.

Shutter The device within the film camera and film projector which blocks the passage of light between frames as the filmstock being advanced. The shutter in the projector is responsible for the subtle flicker. Roughly half of the time one spends watching a movie is spent in darkness.

16mm The generic name adopted for motion picture filmstock developed in 1921 that is still in popular use-- especially in lower budget productions. The term refers to the width (or gauge) of the film strip: 16 millimeters or about 5/8" of an inch. There are several kinds of color and black & white stocks available in this format.

Sound Elements In multi-track sound production, the individual elements (recordings) that are made for use in one of the three planes of soundtrack space: Foreground, Middle-Ground and Background. See individual definitions of these planes for the sonic characteristics they possess.

Soundtrack Space The illusion of a realistic sound environment in soundtrack production through the establishment of at least two planes of loudness (Foreground [close] and

Background [far]). Often a third plane is established with intermittent sound elements of medium volume (Middle-Ground). The illusion of space is often created by recording the sound element(s) of each plane separately in the field and carefully controlling their relative volumes and tonalities with multi-track equipment in post-production.

Stereophonic Sound A two channel, two loudspeaker audio system that can give the listener an increased illusion of depth in soundtrack space through subtle timing differences and element positioning.

Superimposition A ghost-like special effect where two separate, semi-transparent images occupy the screen at the same time. Achieved by rewinding exposed film in a camera and adding another exposure on top of the first. An unlimited number of "layers" are possible with correct exposure adjustments.

Sustain A sense of continuation in a sound element.

Synchronization The simultaneity of a sound with a visual event in an audio/visual temporal form like film or video. Note that the synchronization can occur with a range of possible relations between sound and image including literal association and metaphor. With synchronized human speech, the illusion of the talking image can be created.

Sync Sound A term used most with dialogue scenes in film or video indicating exact image to speech synchronization or "lip sync." The phrase is also used to clearly distinguish this precise sound-image relationship from voice-over and other approximate sync forms.

Sync Having to do with the frame for frame timing relationship between the sound and the picture during sound editing.

Rhythm A pattern created by the awareness of articulated events in time. The articulations can be made up of just about any sound or picture attribute thing as long as they stand-out enough for the listener/viewer. The pattern usually creates some degree of expectation though it may be regular of comparatively irregular.

Subjective Camera The impression that the camera is positioned so that it the shot seen is the viewpoint of a character or that of a protagonist or filmmaker.

Symmetry A composition in which there is a close or exact mirrored correspondence of shapes on both sides of a dividing line-- especially if the dividing line in vertical.

Texture If an image has noticeable texture there are often areas with regular or semi-regular patterning or granularity.

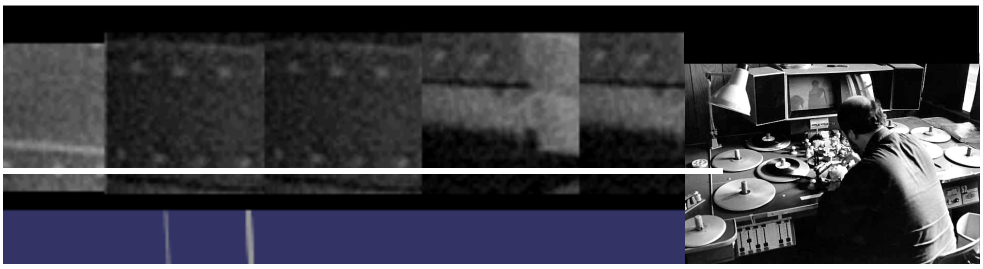
Treble The highest two octaves of the human hearing range-- roughly 4000 Hz to 16,000 Hz. For example, the "treble" knob on basic audio equipment affects the volume over this frequency range with less effect on volume below 4,000 Hz.

Voice-Over A voice sound element in a soundtrack occurring without the image of the person producing the recording. The person may be established visually and then continue speaking "over" other images, but increasingly, voice-over is used without visual representation of the performer. Voice-over is common with narration.

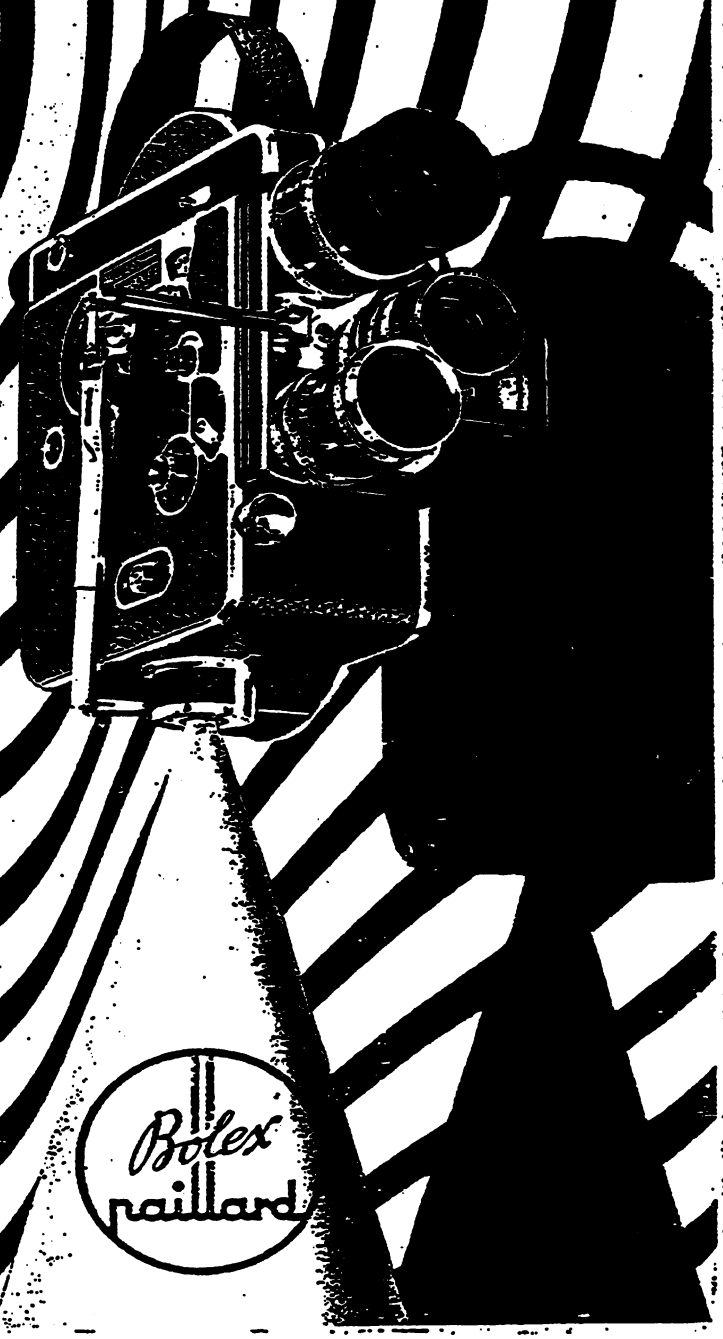
Wild Sound A term used to distinguish sound recordings made with an audio recorder which does not have the ability to run in exact synchronization with a motion picture film camera.

Wild-Sync A close approximation of "lip sync" achieved by carefully aligning a wild sound recording to match in the editing stage. This dubbing process can also be applied to any sound including middle-ground effects.

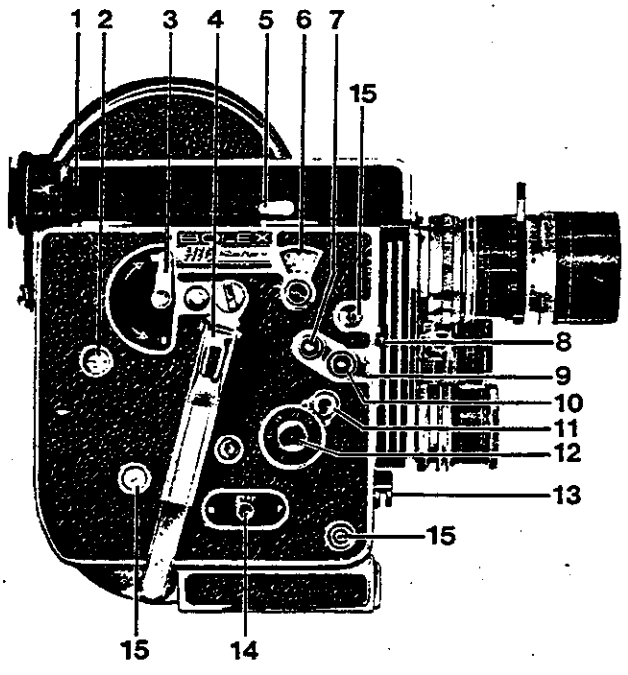
Appendix



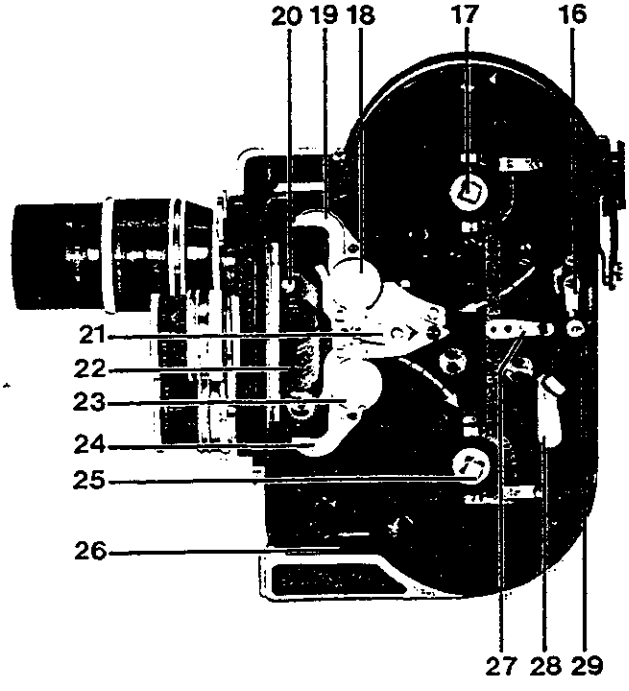
H16 REFLEX



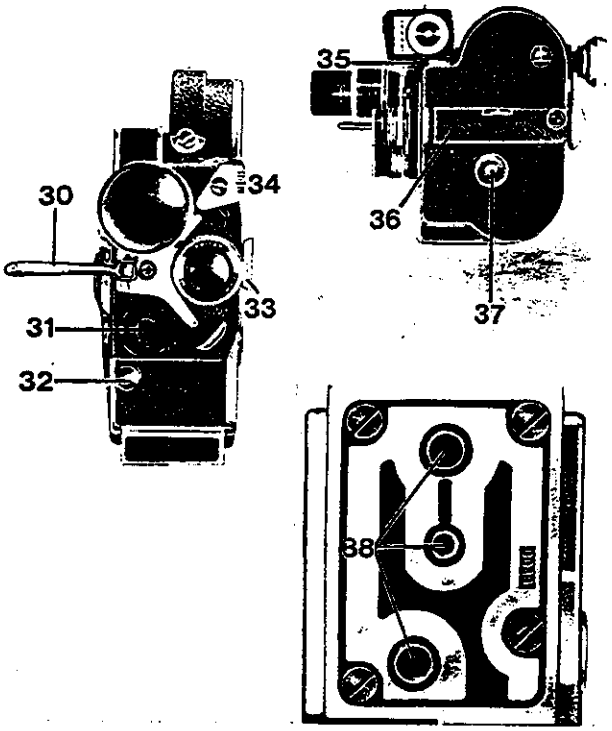
Bolex paillard



1 Reflex viewfinder (page 8)
2 Footage counter (page 29)
3 Lever for disengaging spring motor (page 16)
4 Spring motor winding handle—spring run: 28 sec. at 24 f.p.s. (page 16)
5 Reflex viewfinder closing lever (page 9)
6 Frame counter (page 29)
7 Coupling spindle for electric motor MCE 17 B and film rewind handle (pages 18 and 19)
8 Variable shutter dial and control lever (page 20)
9 Film plane guide mark
10 Coupling spindle for electric motor MST (page 18)
11 Exposure control knob for instantaneous (I) or time exposures (T)
(single frame filming) (page 17)
12 Film speed selection knob (page 16)
13 Front release for normal running (page 17)
14 Side release for normal running, continuous filming (M) and single frame exposures (P). Can be operated by cable (page 17)
15 Threaded holes for various accessories and motors



16 Lever for suppressing audible signal (page 30)
17 Upper spool shaft for feed spool
18 Upper loop former
19 Upper sprocket
20 Pressure pad locking pin (page 27)
21 Loop former locking lever and opening knob (page 28)
22 Pressure pad (page 27)
23 Lower sprocket
24 Lower loop former
25 Lower spool shaft for take-up spool
26 Film knife
27 Spool ejector (page 31)
28 Retaining arm
29 Feet setting on footage counter (page 29)



30 Turret lever (page 11)
31 Threaded hole for turret locking screw
32 Front release for normal running (page 17)
33 Filter holder (page 14)
34 Turret locking clamp (page 11)
35 Shoe for attaching exposure meter (page 13)
36 Auxiliary multifocal viewfinder (page 9)
37 Lid opening ring
38 Three threaded holes (2—3/8" dia and 1—1/4" dia) for tripod or hand grip
39 Serial number of the camera (page 1)

16 mm films

The H 16 Reflex camera takes 100 or 50 ft. spools of single or double perforated 16 mm film. Films with a single row of perforations are used when a magnetic track is to be added to the original film.
At each extremity of the film there is a leader—approximately 6 ft. at the beginning and 3 ft. at the end—to prevent the sensitive film being exposed to light during loading or unloading. These leaders are usually removed by the processing laboratories.

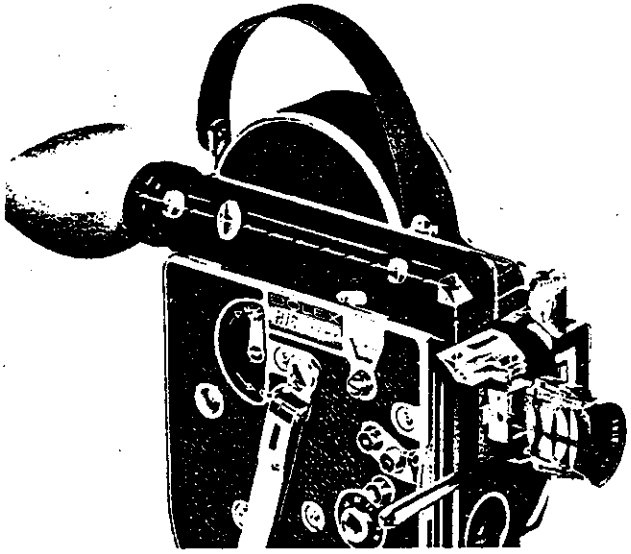
Black-and-white and colour films come in various sensitivities, which are expressed in ASA or DIN degrees and indicated on the instructions leaflet accompanying each film. The date before which the film should be exposed is normally stamped on the film pack. 16 mm film is available in the unprocessed condition with a magnetic stripe for sound recording. We would advise you against using this film: the magnetic layer can cause premature wear on the parts which come into contact with it, particularly the pressure pad, and metal particles may find their way into the camera mechanism.

Film running times at the following filming speeds

f.p.s.	12	18	24	32	48	64
1 m (~ 3 ft)	10.9 sec.	7.3 sec.	5.5 sec.	4.1 sec.	2.7 sec.	2 sec.
15 m (~ 50 ft)	2 min. 44 sec.	1 min. 49 sec.	1 min. 22 sec.	1 min. 1 sec.	41 sec.	30 sec.
30 m (~ 100 ft)	5 min. 28 sec.	3 min. 38 sec.	2 min. 44 sec.	2 min. 3 sec.	1 min. 22 sec.	1 min. 1 sec.

The reflex viewfinder

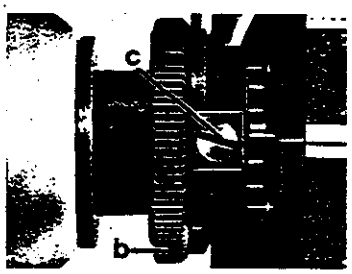
The optical system of the H 16 Reflex camera allows for through-the-lens viewing during filming as well as when the camera is not running. The picture formed on the ground glass of the reflex prism is absolutely free from flicker.
The reflex viewfinder enables framing and accurate focusing of the subject to be achieved. In addition, it enables you to estimate the depth-of-field, to determine the correct focal length, to check on the filter being used and to evaluate the illumination of the scene.
The reflex prism deflects, into the viewfinder, an average of 20-25 % of the light passing through the lens. This factor has been taken into account in the table of exposure times on page 13.



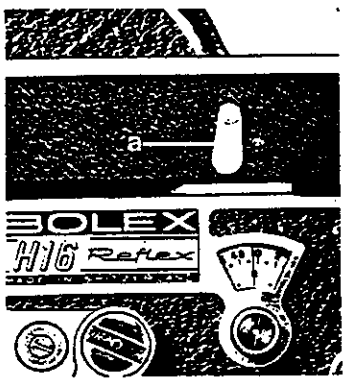
Adjusting the viewfinder eyepiece to the operator's eyesight. This adjustment adapts the viewfinder to the operator's eyesight, whether or not he wears spectacles, and remains the same for all lenses used on the camera. It is advisable to check this adjustment from time to time.

1. Turn the turret to expose the reflex prism.
2. View a well-lighted subject.
3. Loosen the milled ring (b) and turn lever (c) until the grain of the ground glass is perfectly sharp. Then tighten the ring (b) which acts as a lock-nut.

If your eyesight is normal, the line engraved on the lever (c) will be opposite the longest line on the fixed ring.

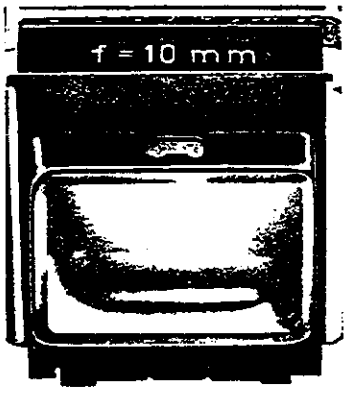


Closing the viewfinder. If the reflex viewfinder is not used during filming, close it by moving the small lever (a) into a vertical position. If it is left open, there is a risk of sunlight or artificial light from behind the camera entering the viewfinder eyepiece and fogging the film.
Focusing. Open the diaphragm wide, then turn the distance setting ring until the picture is in sharp focus on the ground glass. Then close the diaphragm to the correct setting.



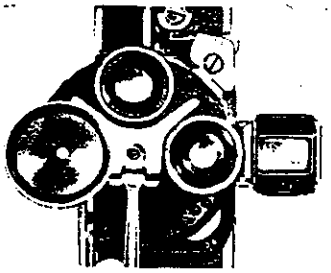
The auxiliary multifocal viewfinder

The H 16 Reflex camera is equipped with a detachable multifocal viewfinder, provided with parallax correction from 20" to infinity. Its field can be instantly and continuously adapted for lenses with focal lengths of 16, 25, 35, 50, 63, 75, 100 or 150 mm. The viewfinder also incorporates an extra lens, mounted on a sliding bracket. Quickly put into place, this lens immediately adapts the viewfinder to the field of a wide-angle lens (10 mm). When this lens is in use, the multifocal viewfinder should be set for the shortest focal length (16 mm).
The auxiliary viewfinder can be mounted or removed from the camera in seconds by means of a lever. It is extremely useful for previewing the subject, and therefore picture composition and focal length can be determined without having to move the camera.



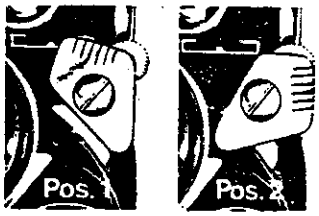
3 4

Optical equipment



The turret. Simply by turning the turret, you can change rapidly from one focal length to another, from a medium long view to a long view or a close-up. To turn the turret, use its fold-away lever. In this way, there is no risk of accidentally moving the diaphragm and focusing rings. Three click stops ensure that the lenses are correctly positioned in front of the filming aperture. When using heavy lenses, such as zooms or telephotos with very long focal lengths, the turret should be locked (Pos. 2) with a special clamp.

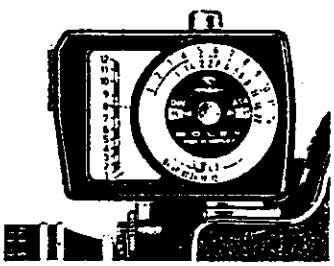
Correct position of the lenses on the turret. Keep the lenses positioned as shown opposite, so that there is a reasonable distance between the wide-angle lens (1) and the long focal length lens (3). It is as well to remove 100 and 150 mm lenses from the turret before using a shorter focal length lens, in order to keep its field clear. When using a heavy lens, such as a zoom, the turret should be locked with a plug.



The lenses. The H 16 Reflex camera takes "C" mount lenses (see important note below) which have the following characteristics:
Thread diameter: 25.4 mm (1")
Maximum thread length: 4.06 mm (.160")
Film plane / lens seat distance: 17.52 mm (.690")
Lenses should be held by their rear rings (a) when being screwed into the turret.
Standard lenses (25 and 26 mm) are suitable for most shots.
Wide-angle lenses (10 and 16 mm) are used for general views or when it is difficult to move back from the subject (buildings, interiors, etc.). They give heightened perspective.

11

Diaphragm setting



The lens diaphragm controls the amount of light reaching the film and is adjusted according to the lighting conditions, the film sensitivity, the filming speed and the position of the variable shutter. The amount of light admitted by the diaphragm is doubled at each successive setting, starting from the highest figure. For instance, moving the diaphragm setting from f/11 to f/8 doubles the amount of light passing through the lens.

The Bolex exposure meter was designed and calibrated especially for the H 16 Reflex camera and allows for the fact that 20-25 % of the light is deflected into the viewfinder by the reflex prism. The exposure meter fits on to a special shoe (see page 6).

The use of the exposure meter safeguards against exposure errors. In the chart opposite, the figures listed in the column under "adapted exposure times" take into account the light deflected by the reflex prism.

Exposure times (in fractions of a second)

Filming speed	Shutter open Lever up		Shutter ¼ closed Lever on ½		Shutter ½ closed Lever on 1	
	Real	Adapted	Real	Adapted	Real	Adapted
12 f.p.s.	1/33	1/40	1/45	1/55	1/75	1/94
16 f.p.s.	1/45	1/55	1/60	1/75	1/100	1/125
18 f.p.s.	1/50	1/60	1/70	1/87	1/110	1/137
24 f.p.s.	1/65	1/80	1/90	1/112	1/150	1/188
32 f.p.s.	1/90	1/110	1/120	1/150	1/200	1/225
48 f.p.s.	1/130	1/160	1/180	1/225	1/300	1/375
64 f.p.s.	1/180	1/220	1/240	1/300	1/400	1/500
Speed control knob on 18-64 f.p.s.	Single-frame exposure		(selector in position T)			
	1/30	1/40	—		—	

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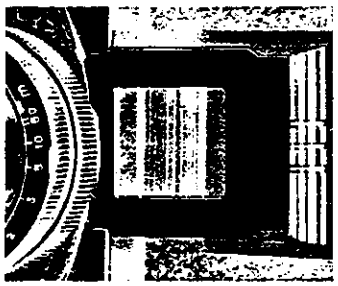
Telephoto lenses (50—150 mm) are used for long distance shots and are ideal for filming sports scenes, children, animals, etc.
To protect lenses from dust and impurities, it is advisable to replace the lens caps between takes.

Important. Special 10, 16, 25 and 50 mm lenses have been designed exclusively for use on the H 16 Reflex camera. Lenses with focal lengths over 50 mm can generally be used equally well on the H 16 Reflex as on cameras without reflex viewfinder.

Focusing

The reflex viewfinder of the H 16 Reflex camera shows you the picture as it will appear on the film, with its sharp and blurred areas faithfully reproduced. It is thus simple to focus accurately and, at the same time, to estimate the depth-of-field.

The depth-of-field is the area within which the picture is in focus. It varies according to the focal length of the lens, the diaphragm opening and the filming distance. The longer the focal length, the wider the diaphragm opening or the shorter the filming distance, the shallower the depth-of-field will be. Focusing must therefore be especially accurate.
Conversely, the shorter the focal length, the smaller the diaphragm opening or the longer the filming distance, the wider the depth-of-field will be—and the greater the margin for focusing inaccuracy.
On most lenses, a depth-of-field scale indicates the distances within which the picture will be in focus. Lenses are also supplied with a depth-of-field chart. Distances are calculated from the film plane, marked ⌀.



Filters

The H 16 Reflex camera has a filter-slot between the taking lens and the reflex prism. The filters therefore remain in place whichever lens is being used. **When filming without a filter, an empty filter holder should be left in the slot to prevent light infiltration which would fog the film. See that the filter mount is firmly located in the slot.**
The set of filters for the H 16 Reflex camera comprises four filter holders, a filter cutting frame and four envelopes, each containing one of the following 2" square gelatine filters.
The effect of a filter varies according to the type of film, its sensitivity and the lighting conditions. The diaphragm corrections below should be considered as only approximate.

Type	Open diaphragm	or divide ASA rating by
Kodak Wratten 1A Skylight	—	—
Kodak Wratten 85 Daylight	$^2/_3$ stop	1.6
Kodak Wratten 8 Yellow	1 stop	2
Kodak Wratten ND 06 Neutral density	2 stops	4

The 1 A Skylight filter for colour films, tones down excessive blue and improves colour reproduction (in the shade or overcast weather, for distant shots, when filming in snow or at high altitudes). This filter requires no diaphragm correction.

The 85 Daylight filter for colour films is a conversion filter. It is used for filming in daylight with Kodachrome II Type A artificial light film. When setting the diaphragm, remember that colour film for artificial light, used with the 85 Daylight filter, has the same sensitivity as a day-light colour film used without filter.

The Yellow 8 filter is used for increasing contrast in black-and-white films.

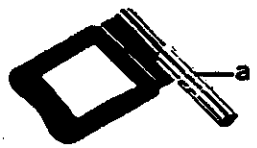
The neutral density filter can be used with both black-and-white and colour films and in no way affects colour reproduction. As the ASA sensitivity is reduced four times, the diaphragm can be opened two stops. This filter is used:

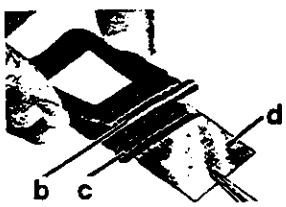
1. When the lighting conditions and the film sensitivity require an aperture lower than the smallest stop on the lens.
2. When it is desired to reduce the depth-of-field in order to achieve special effects (sharp foreground against blurred background).

Mounting gelatine filters. Filters are mounted as follows:

1. Hold the filter cutting frame horizontally (g).
2. Insert gelatine filter, with its protective covers, as far as it will go into the frame.
3. Hold the frame firmly and cut around it with sharp scissors.
4. Remove the filter by its edges. Fingerprints cannot be removed.
5. Remove the fastening clamp (a) from the filter mount.
6. Open the spring blades (b) and (c).
7. Insert the cut-out-filter (d) between the blades.
8. Press the spring blades (b) and (c) together between thumb and index finger.
9. Replace the fastening clamp (a).

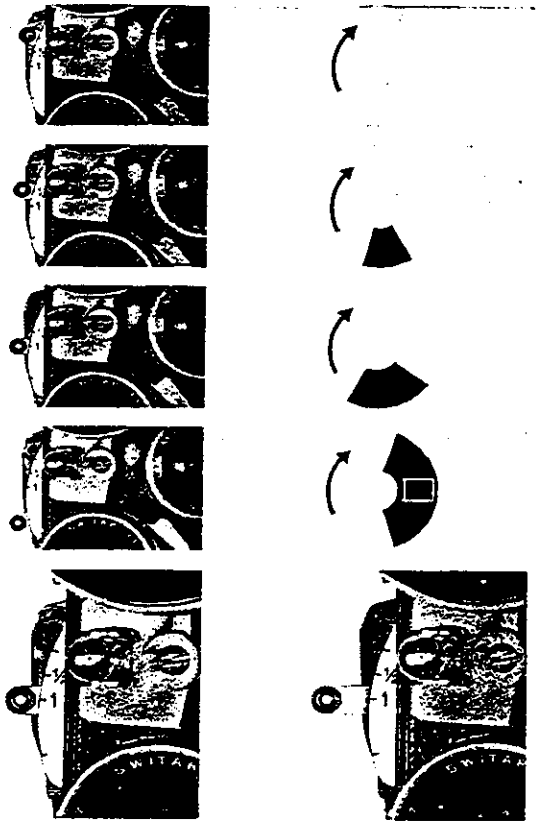
When you have finished, put the filter-mounts in their case to protect them from dust.





Focusing adjustment. Placing a filter behind the lens slightly alters the lens focusing. However, the necessary correction is automatically made when the reflex viewfinder is used.

Important. Because of its distance from the film plane, the filter mount cannot be used as a mask holder for trick effects, such as keyhole and binocular cut-outs. The shape of the mask will not appear on the film and it will only darken the scene.



The variable shutter

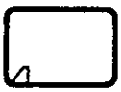
The H 16 Reflex camera is equipped with a shutter whose aperture can be varied both when the camera is running and when it is stopped. This enables you to reduce exposure time without changing the filming speed. In dazzling light, such as snow and water scenes, the variable shutter can be used to reduce exposure, thereby often eliminating the need for a neutral density filter.

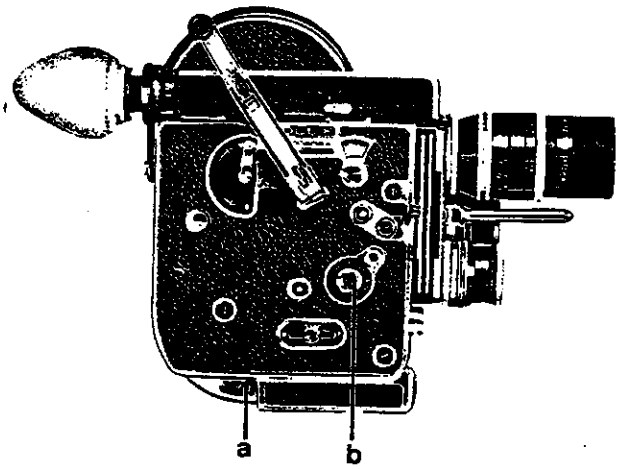
The shutter can be locked in each of its four positions by pushing the lever inwards. The ¼ and ½ closed positions are marked on the face of the lever by the figures ½ and 1, which signify:

¼ closed position (marked ½): the diaphragm should be opened half a stop to compensate for the reduced exposure time, due to the shutter being ¼ closed.

½ closed position (marked 1): the diaphragm should be opened one stop.

A triangular warning signal appears in the reflex viewfinder when the variable shutter is not in the fully open position.





Winding the motor

Move the side release to STOP and the motor disengaging lever to MOT. Lift the motor winding handle, which automatically engages with the spindle, and turn anti-clockwise. Wind the spring motor fully but without forcing it, then lower the handle and secure it on catch (a). Otherwise, there is a risk of it turning with the motor during filming.
Fully wound, the motor drives nearly 18 ft. of film, i.e. 28 seconds' filming time at the speed of 24 f.p.s. Make a habit of rewinding the motor after each take, regardless of how much power is still in reserve.

Film speeds

The camera has seven filming speeds: 12, 16, 18, 24, 32, 48 and 64 frames per second.
To select the desired speed, turn the control knob (b) until the corresponding figure is opposite the red dot. When the film is projected at normal speed (18 or 24 f.p.s.), a lower filming speed will produce an accelerated motion effect while a higher filming speed will give a slow motion effect. When changing film speed, do not forget to alter the diaphragm setting. When changing from 24 to 32 f.p.s., the diaphragm should be opened half a stop, from 24 to 48 f.p.s. by a whole stop and from 24 to 64 f.p.s. by 1½ stops (see page 13).

Important. When the camera is not loaded, it should not be run at speeds over 32 f.p.s. as this could damage the mechanism.

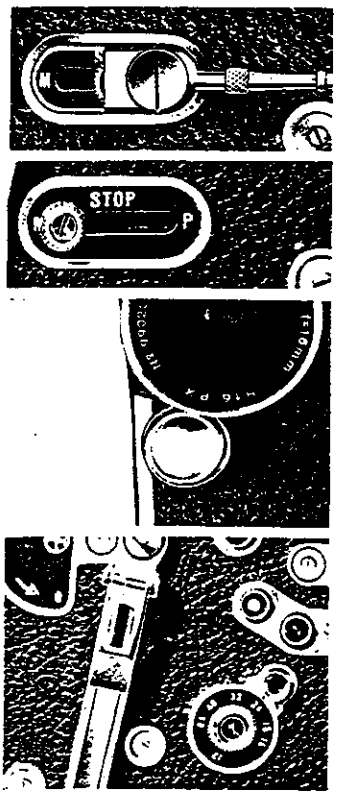
The release selector

The H 16 Reflex camera can be used for normal, continuous or single-frame filming. These different operations are controlled by the **side release.**

Normal filming. This filming method is suitable for most general shots. The camera runs as long as the operator depresses the front release or pushes the side release towards M (generally by using a cable).

Cable release. For maximum stability, when the camera is mounted on a tripod, it is advisable to use a cable release which fixes, by means of an adapter, on to the side release knob.

Single frame filming. Push the side release to P.
Instantaneous: turn the knob until the guide mark is in position I. **Time exposures:** guide mark in position T (for use in poor lighting conditions, such as indoors).
When making time exposures, open the variable shutter fully or one of its blades may mask part of the picture.
You can also use an electric motor which ensures absolutely constant exposure time for every frame at the selected speed. This prevents the slight flicker which ...evitably results from using a spring motor (see page 47).
...igle frame filming is used for titles, cartoons, scientific films and various trick effects, particularly accelerated motion (clouds, sunsets, comic effects, etc.). Use a cable release to prevent any risk of camera movement.



B

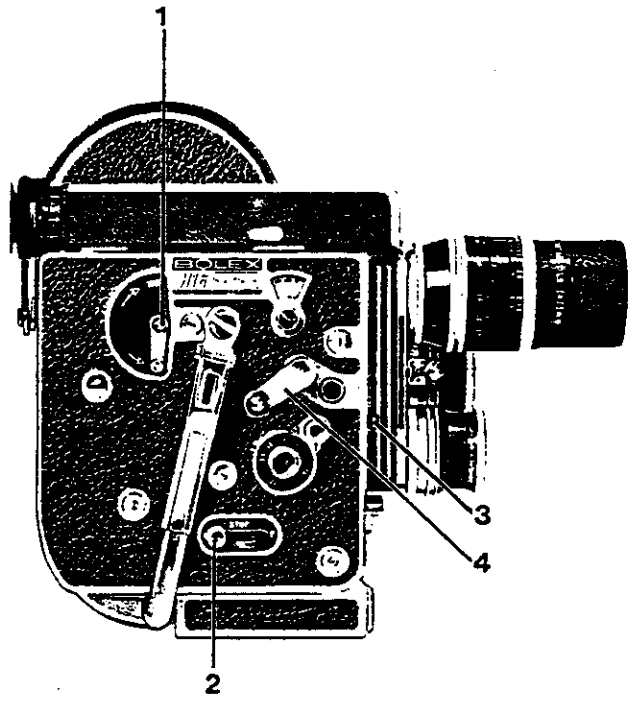
Hand cranking. The mechanism of the H 16 Reflex camera can operate in reverse as well as forward motion by means of a small auxiliary crank. The spool can thus be fully rewound and a partly exposed film removed from the camera. This is particularly useful for special effects, such as lap dissolves, double exposures and trick effects.

To rewind the film:

1. Disengage the motor by moving lever (1) to O. If you feel a slight resistance towards the end, do not force the lever but press the front release while continuing to move the lever.
2. Move the side release (2) to M (continuous filming).
3. **Close the variable shutter** by lowering lever (3) so as not to fog the film (see page 20).
4. Turn the hand crank (4) in the direction of the engraved arrow but do not try to rewind the film faster than allowed by the speed governor.

To resume normal motor-driven operation, move the side release to STOP and the disengaging lever to MOT.

Do not forget to re-open the variable shutter.



Important. The reverse system is designed for rewinding only and should not be used for filming.

Use of the variable shutter. The variable shutter enables you to achieve various effects, without the need for any other accessories. Some are described below.

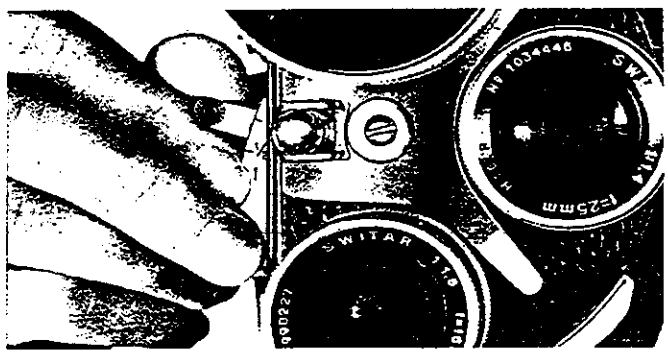
Dissolves

Fade-in. A film beginning abruptly with a title or a brillantly lit scene may dazzle the eyes of an audience in a darkened room. The eye needs only between ½ second and 2 seconds to become adapted to the brightest screen image, if the transition is gradual. In such cases, it is a good idea to introduce the opening scene with a fade-in, using the variable shutter, as follows:

1. Close the variable shutter without locking the control lever.
2. Start the camera with the left hand while simultaneously opening the shutter with the right, using the lever. To ensure a smooth movement, press the middle finger against the edge of the turret and, holding the small black lever knob firmly between thumb and index finger, move the lever gently forward (see picture opposite).

Before beginning to film, practice making this movement smoothly and, particularly, making it last the desired time. Duration can be checked by repeating aloud a previously timed phrase. Alternatively, you can use the audible signal (see page 30).

3. Continue filming until the end of the first sequence.
4. For safety's sake, lock the lever in the "open" position before filming further sequences.



Fade-out. A gradual darkening at the end of the last scene avoids an abrupt finish. The fade-out can be slower than the fade-in and is achieved in the same way, only in reverse order.

Transitional fade. If you cannot avoid linking two scenes with an appreciable difference in light, the transition will be smoother if you end the first scene with a fade-out and begin the second with a fade-in. To avoid a break in continuity, these two fades should not last longer than two or three seconds.

Lap dissolve. A lap dissolve is unquestionably one of the most pleasing ways of linking two sequences. It is made by superimposing a fade-in on a fade-out so that one picture gradually disappears as the next gradually appears. This makes for a very smooth transition during which the picture brightness scarcely varies.

To produce a lap dissolve:

1. Close the sequence with a fade-out, without interrupting filming and without regard to the frame counter.
2. Lock the shutter in the "closed" position.
3. Set the two dials of the frame counter to zero.
4. Disengage the motor and rewind the film in reverse until the frame counter indicates the figures corresponding to the duration of the fade-out. An example is shown on the table opposite (page 23).
5. Move the side release to STOP and the lever to MOT.
6. Frame the second sequence and release the shutter lever.
7. Press the release and simultaneously make a fade-in of the same length as the previous fade-out.
8. Continue filming.

N. B. Producing these fades is greatly facilitated by using the variable shutter automatic control, the REX-FADER (see page 45).

Duration of fade in seconds	Filming speed	
	18 f.p.s.	24 f.p.s.
1½	973	964
2	964	952
2½	955	940
3	946	928

Double exposures

In order to enhance the artistic effect of a sequence, the professional cameraman sometimes uses double exposures, i.e. the superimposing of two different scenes filmed on the same length of film.

a) **To double expose the whole sequence:**

1. Set the lens diaphragm according to the lightmeter reading.
2. Half close the variable shutter by locking the lever in position "1".
3. Set the frame counter to zero.
4. Film the first scene.
5. Note the reading of the frame counter.
6. Fully close the variable shutter and lock the lever in that position.
7. Disengage the motor and wind the film back until the frame counter again reads zero.
8. Engage the motor.
9. Free the variable shutter lever and lock it in position "1".
10. Film the second sequence until the frame counter reaches the figure noted under point 5.
11. Open the variable shutter and lock its lever in that position.

b) **To double expose only part of the sequence:**

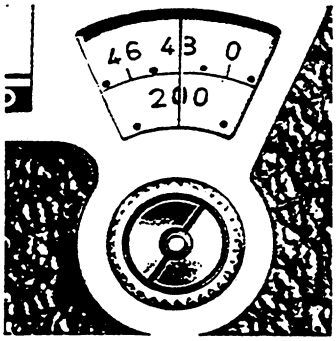
1. Set the lens diaphragm according to the lightmeter reading.
2. Film the beginning of the scene, stopping when you reach the point where you intend to introduce the double exposure.
3. Set the frame counter to zero and free the variable shutter lever.
4. Continue filming. Start with a semi fade-out of about 1½ seconds, by lowering the lever to position "1". Lock the lever in that position without stopping filming.
5. Stop filming where you want the double exposure to end and note the frame counter reading.
6. Free the variable shutter lever.
7. Continue the sequence with a semi fade-in of about 1½ seconds and end it with the lever locked in the "open" position. Note the frame counter reading.
8. Fully close the variable shutter and lock the lever in that position.
9. Disengage the motor and wind the film back until the frame counter reads zero.
10. Engage the motor and free the variable shutter lever.
11. Film the superimposed scene, beginning with a semi fade-in of about 1½ seconds, by moving the lever to position "1" and locking it without stopping filming.
12. Stop filming when the frame counter reaches the number noted under point 7.

N. B. Use a tripod for such sequences and, if possible, have an assistant.

The footage counter

The footage counter shows the length of film that has been exposed. Once the camera is loaded, this counter reads **ft.** Run the camera until the figure 0 arrives opposite the white line in the centre of the red mask. This indicates that the film leader has been taken up and you can start filming. The counter automatically returns to **ft.** when the camera lid is removed for loading or unloading film.
The footage counter is sufficiently accurate for ordinary filming. For special effects that require absolute precision, the frame counter should be used.

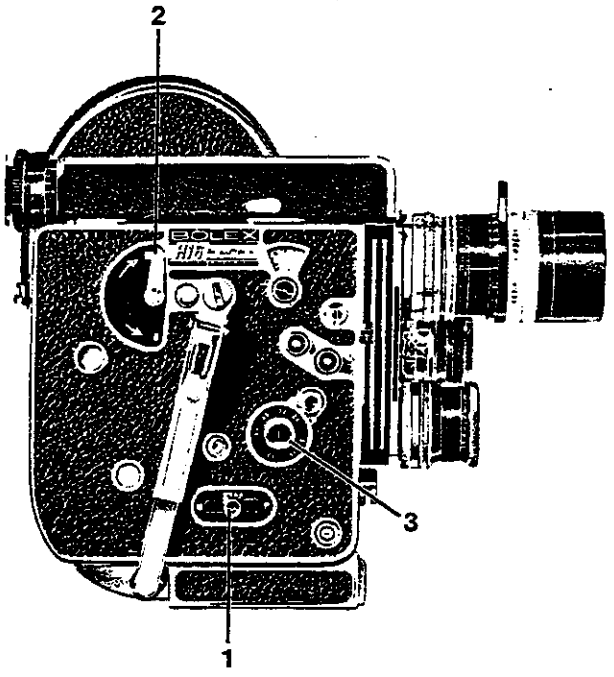
The frame counter



By indicating the exact number of frames exposed, this counter is invaluable for scientific studies, as well as various effects, such as lap dissolves and double exposures. It is also very useful for single frame filming (animation technique, see page 37).

The upper dial adds the frames in forward run and subtracts them in reverse run, from 0–50 frames.

The lower dial totalizes, in units of 50, the frames in forward run and subtracts them in reverse run, up to 1000 frames.



Now that you are familiar with the various features of your camera and know how they are operated, you are ready to start loading.

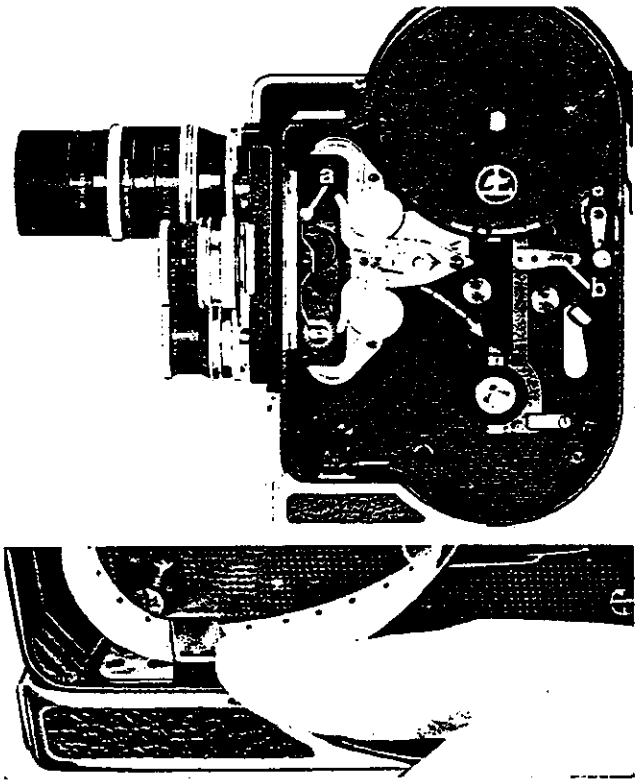
To avoid exposing the edges of the film to light, the camera should be loaded in a dimly lit place, well away from sunshine.

Before loading the camera:

1. Set the side release (1) to STOP.
2. Set the disengaging lever (2) to MOT.
3. Move the selection knob (3) until the number corresponding to the desired filming speed faces the red dot.
4. Wind the camera (page 16).

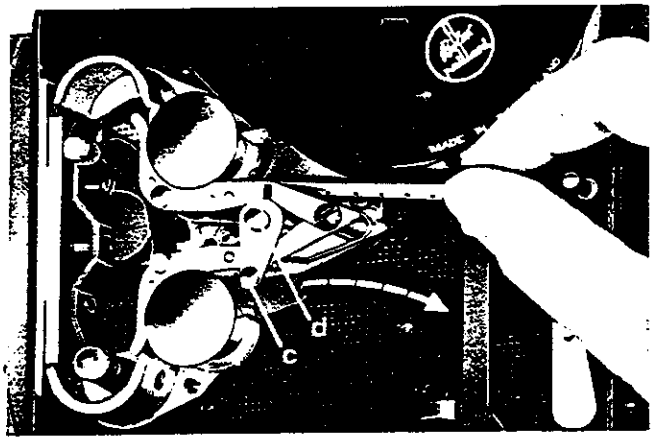
Inserting the film

Lift the lid opening ring, turn it in the direction marked by the arrow O, then lift off the lid. The inside of the camera is as shown in the illustration.



Prepare to load the film as follows:

1. Check that the pressure pad pin (a) is locked and that the pressure pad cannot open.
2. Remove the empty spool from its spindle by pressing ejector (b) and place the spool holding the film on the upper spool shaft (film should run in the direction indicated by the engraved arrow).
   In the film gate, the dark, shiny side of the film (the backing) should face towards the back of the camera and the light matt side (sensitized) towards the lens.
3. Using the film knife, cut off the end of the film diagonally between two perforations, as shown in the illustration. Remember to remove the piece which has been cut off.
4. Close the loop formers by moving the control lever parallel to the pressure pad.



5. Press the release while simultaneously pushing the end of the film against the sprocket (illustration opposite). **The film is automatically threaded into the camera.**
6. Continue to depress the release until 10 to 12" of film have passed through the drive mechanism.
7. Open the loop formers by pressing knob (d). (If you accidentally leave them closed, they will automatically open when the camera lid is replaced.)
8. Insert the end of the film into the slot in the core of the take-up spool. Rotate until about three turns of film have been taken up and place the spool on the lower spool shaft.
9. Turn the take-up spool by hand, clockwise, to take up any slack film.

Final check. Press the release and run the camera for several seconds to ensure that the film advancing normally and the loops at either end of the film gate are forming correctly.
Replace the lid and lock it by turning the ring in the direction indicated by the arrow F. If it does not lock, do not force the ring! The spools or the pressure pad may be incorrectly positioned.
Finally, press the release until the film leader has been taken up. The camera is now ready for use (see following pages).

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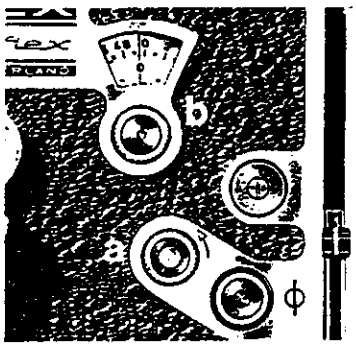
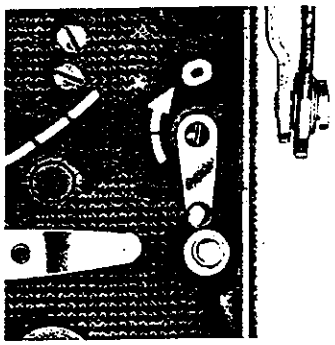


Beyond this figure, the cycle starts again and the figures shown on both dials should be added to the 1000 frames already totalized. Take no notice of the relative positions of the dials but only of their readings.

You can easily check if the figures shown on the frame counter refer to the first or second cycle, by looking at the footage counter. 1000 frames of 16 mm film correspond to 25 ft.

To set the frame counter to zero, use knob (a) which controls the upper dial and knob (b) which controls the lower "totalizer" dial.



Audible signal

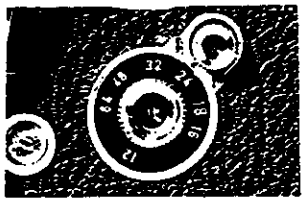
A clicking sound marks the passage of each 8" of film and is heard approximately every second at the speed of 24 f.p.s., every 1½ seconds at 18 f.p.s. The length of a scene can thus easily be estimated while filming. To reduce the strength of the audible signal, or to eliminate it altogether, move the small lever inside the camera, next to the counter pin, towards zero.

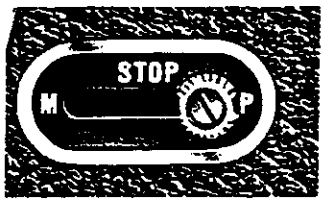
30

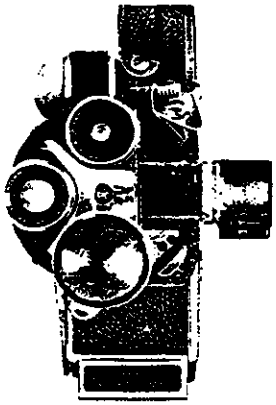
After the film is fully exposed

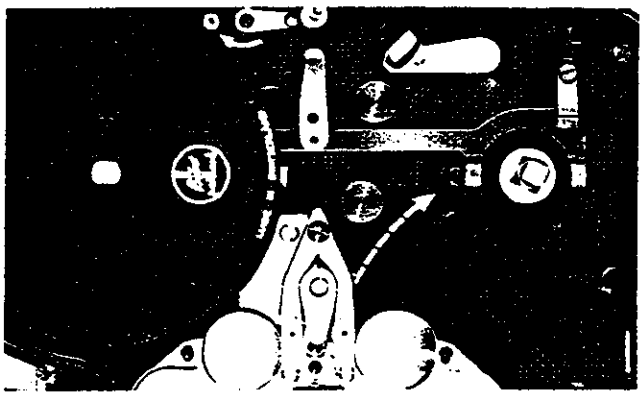
When the footage counter shows that the film is entirely exposed, run the camera for about 10 seconds to wind the end leader on to the take-up spool. Before opening the camera, make sure there is no film left in the gate, as follows:

Move the exposure knob guide mark to position T and turn the turret to reveal the aperture. Then push the side release to P to open the shutter. If any film remains, it will be seen, as an ivory coloured rectangle, in the aperture. Only one frame will be lost by making this check. Do not open the camera in bright light or the sensitive film may be fogged.



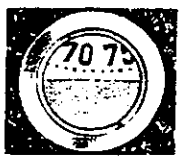


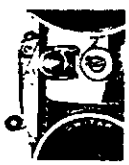


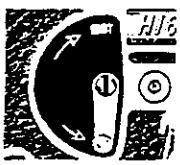


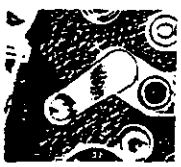
Spool ejector. This device simplifies spool changing.

A slight pressure on the ejector lever frees both spools, which can then easily be removed from the camera. Holding it firmly so that the film cannot unwind, place the full spool in its metal container.







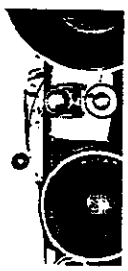


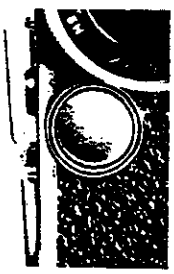
When the film is only partly exposed

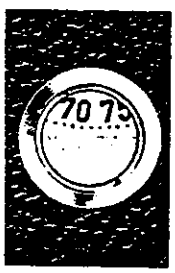
A partly exposed film can be removed from the camera as follows:

1. Note the figure on the footage counter.
2. Close the variable shutter.
3. Disengage the motor and rewind the film until the sign **ft.** appears opposite the white line in the mask.
4. Open the camera lid and unload the camera in a dim light.
5. Do not forget to open the variable shutter before beginning the new film.

To replace a partly exposed film in the camera:







6. Load the camera as described on page 26.
7. Close the variable shutter.
8. Press the release until the footage counter reaches the figure already noted.
9. Before beginning to film, it is advisable to press the release and run the camera for a second or two, to avoid the risk of double exposure.

N. B. For greater accuracy, use the frame counter which enables you to recommence filming from exactly the frame where you left off.

Film all black	Variable shutter left closed.
Film under-exposed, pictures reversed, general orange tint	Film incorrectly loaded with dark side facing towards the lens.
Pictures too dark and flat	Under-exposure (too small a diaphragm opening for the filming speed, film sensitivity and shutter aperture).
Pictures too clear and washed-out	Over-exposure (too wide a diaphragm opening for the filming speed, film sensitivity and shutter aperture).
Blurred pictures	Inaccurate distance setting.
"Jumpy" pictures	Camera unsteadiness or panning too rapidly.
Unnatural colouring	Using filters designed for black-and-white film when shooting in colour. Too long a delay between exposure and development. Films poorly stored before or after exposure.
Dominant red-orange tint	Filming too early in the morning or too late in the evening. Using tungsten lamps with a daylight type film or an under-powered lamp with "artificial light" film.
Dominant blue tint	Filming distant subjects at high altitudes or on water without the appropriate filter. Water scenes with strong reflections, filmed without polarizing filter.
Partly obscured pictures	An object, such as a finger or a long telephoto lens, in front of the taking lens. Turret badly positioned.
Parallel scratches on the edge of the film	Dust or particles of emulsion in the film gate. Camera badly loaded.
Fogged film	Direct light entering through the reflex viewfinder.
Film fogged at edges	Careless loading or unloading of the camera so that sensitive film was accidently exposed to light. The filter-mount left out of its slot.
Out-of-focus or distorted picture	Pressure pad incorrectly locked.

Carefully following the instructions in this booklet, you will help to avoid the above mistakes and produce excellent films.

SEKONIC

STUDIO DELUXE II L-398M

Operating Instructions

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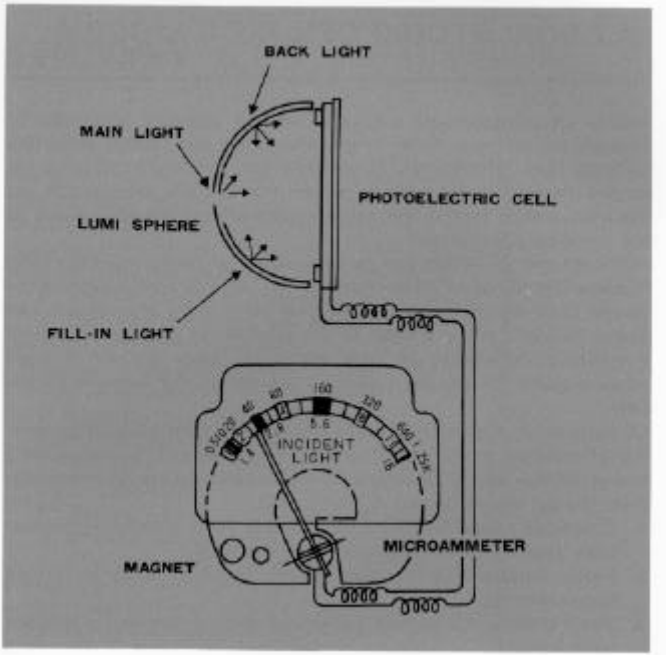
SEKONIC STUDIO DELUXE II L-398M FEATURES

Nearly all photographic subjects combine complex variations of strongly reflecting surfaces (high reflectivity) and weakly reflecting surfaces (low reflectivity). These variations delicately influence exposure determination and to which portion the exposure is set becomes a vital factor that considerably affects the appearance of the finished photograph.

Although risk of failure can be minimized by taking maximum and minimum readings of all portions of the subject, then averaging the values, such an approach is both time consuming and tedious. The Studio Deluxe II is the answer to this problem. It is designed around a standard reflectivity of 18%, which has been derived through measurements of various subjects throughout the seasons of the year.

Consequently, high effectiveness is displayed with subjects possessing reflectivities in the neighborhood of 18% (people, buildings, etc.) and when this can be considered the average value (street snapshots, trees, forest scenes, etc.).

1. Optimum exposure meter for incident light measuring method (also applicable for reflected light method).
2. Freely rotatable light sensor section for very easily performed measurements.
3. Meter stopper mechanism allows operation while hand is released from meter.
4. Meter release mechanism is also included which allows the needle to deflect freely. This provides greater convenience when determining light balance.
5. Memo pointer enables easier light balance setting.
6. Lumisphere detects the same light as strikes the subject. Since subjects are normally 3-dimensional, according to the lighting conditions, brighter surfaces (highlights) and darker surfaces (shadows) are produced (illumination contrast). The Studio Deluxe II mechanism automatically takes into account the strength of light from all directions, causing the meter to indicate a value applicable to photography. It is thus most convenient for determining typical exposures.



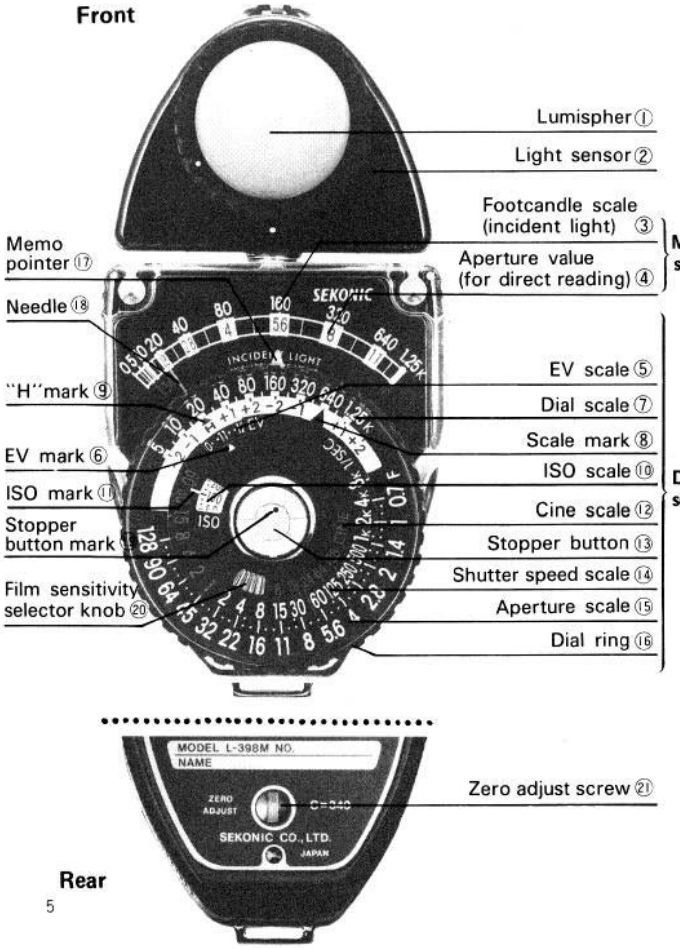
7. After combining film sensitivity and shutter speed, direct reading slides (optional) can be used for directly determining the aperture value.
8. Selenium photocell is employed as light sensing element, eliminating need for battery.
9. Wide selection of available accessories allows numerous photographic techniques to be enjoyed.

SPECIFICATIONS

Measuring System	Incident light (reflected light system also capable)
Measuring Range	At ISO 100, EV 4-1 7
Measuring Accuracy	Within ± 0.3 EV (1/3f stop)
ISO Scale	6 - 12000
Shutter Scale	60 - 1 /8000 second
Aperture Scale	0.7-128
Cine Scale	8 fps - 128 fps
EV Scale	1 20 (exposure value)
Calibration Constant	C = 340 K = 1 2.5
Dimensions	112 x 58 x 34 mm
Weight	Approx. 190 grams

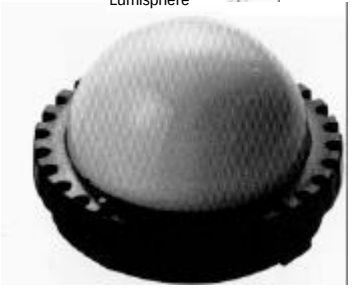
(NOTE) The outlooks and specifications described in this booklet shall be changed without pre-advice, if necessary.

PART DESIGNATIONS

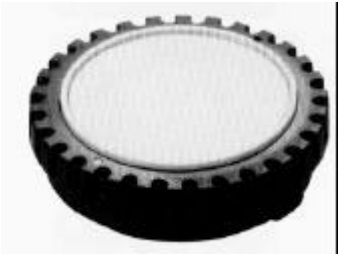


ACCESSORIES

Lumisphere



Lumidisc



Lumigrid

High (H) slide

Optional Accessories
(sold separately).
Direct reading slides.

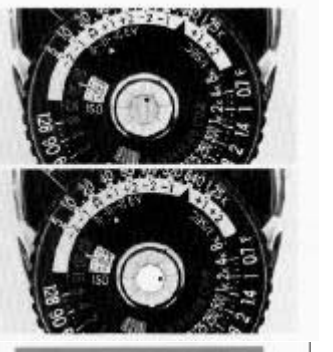
Total of 11 direct reading slides (set of 11 slides in case).

BASIC OPERATION OF METER UNIT

1. Stopper Button Operation

If the stopper button ⑭ is pressed when the stopper button mark ⑲ is set to ◷ the meter needle ⑱ deflects according to brightness. Then when the button is released, the needle remains fixed at the indicated position.

By holding the stopper button depressed and turning it clockwise so that the mark position becomes ○ the needle is released. At this time, the meter will deflect freely even if the stopper button is released. To fix the needle, turn the stopper button counter-clockwise to where the mark is positioned ◷

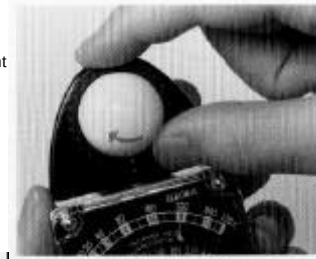


With stopper button in released ○ position, cover light sensor with hand or black cloth to completely block light. Check that meter needle ⑱ correctly indicates zero position. If the indication deviates from zero, while observing meter indication, use a coin or similar tool to turn the rear zero adjust screw ㉑ and adjust for zero indication.

Incident Light Measurement

1. Lumisphere

a. Mount Lumisphere ① sensor ② . To white dots of Lumisphere frame and light sensor, then turn Lumisphere carefully clockwise to secure.

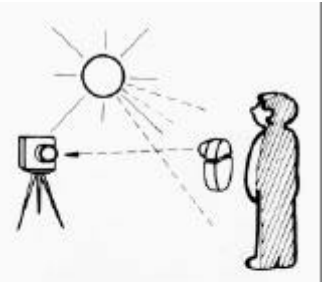


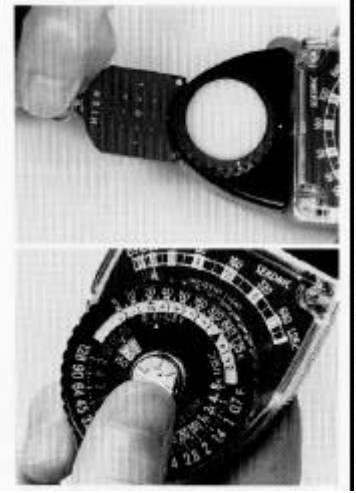
b. Set film sensitivity knob ⑭ to sensitivity value of employed film. Set ISO value to right side ISO mark ⑪ . Photo shows setting for ISO 100.

c. From position where subject is to be measured, point Lumisphere ① in direction of camera. (Light sensor ② be turned freely.)

d. Hold meter erect and press stopper button ⑬ Meter

needle (18) deflects according to brightness. When the stopper button is released, the meter needle becomes fixed at the deflected position. If the location is excessively bright and the meter needle deflects beyond scale, insert the High slide (22).





e. Read the footcandle indication (3) of the meter needle.

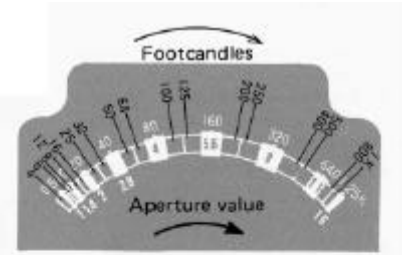
f. Transfer footcandle value to the dial scale (7). dial ring (16) and set the ▲ scale mark. If the High slide (22) has been inserted, set the ▲H mark.

g. At this time, the shutter speed scale combination becomes the correct exposure.

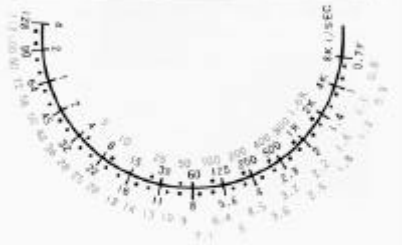
14 and aperture scale 15

Example: With High slide inserted, meter indicates 80 footcandles At ISO 100, the proper exposure becomes 1, 250 sec at F 5.6, 1; 30 sec at F!16 and 1 sec at F-90. h. By changing ISO setting, the set combination of shutter speed and aperture scale is automatically altered to the appropriate one corresponding to the changed ISO value.

*** Meter scale intermediate values**

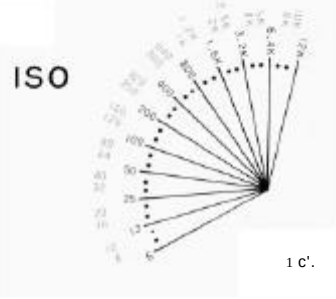


intermediate values for shutter speed and aperture scale



*** Film sensitivity intermediate values**

Note: When no slide is inserted, strong light directly striking the slide slot may enter through the slot. Although this does not seriously affect exposure, if more accurate exposure is required, cover slot with hand.



2. Lumidisc. Employ for illumination contrast Adjustment and luminance measurement.

• Contrast measurement

a. Mount Lumidisc sensor (21) Install in the same manner as Lumisphere. (2)

b. Hold meter at subject position and point Lumidisc directly toward center of main light. (6)

c. Press stopper button (13) read meter scale footcandle indication (3)

d. Turn the memo pointer dial and set the pointer 1 7 at the footcandle value the needle points to

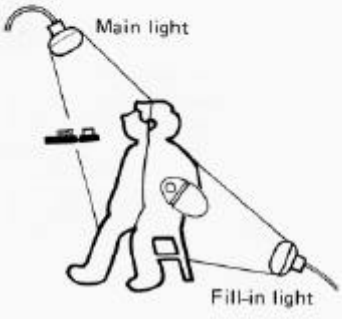
e. In the same manner, measure the fill-in light. In this case, use care that light from main source dose not enter sensor.

f. Read a difference between the footcandle value the pointer is set (see above c) and the one for fill-in light (= needle position.

Ratio between main and fillip light footcandles becomes the contrast ratio.

Example: With main light at 640 footcandles, fill-in light reads 320 footcandles. Illumination contrast ratio becomes:

$$\frac{640}{320} \quad \frac{2}{1} \text{ or } 2:1$$



- Luminance (Lux) measurement

a. Mount Lumidisc (23) to light sensor (2) in the same manner as Lumisphere.

b. Place Lumidisc (23) parallel with the measured surface.

c. Press stopper button (13) and read meter scale footcandle indication (3).

d. Multiply this value by 10.76 to obtain lux.

Example: 80 x 10.76 = 860.8 lux

If meter deflects beyond scale, insert High slide (22) then multiply footcandle indication by 32.

Example: 80 x 32 = 2560 footcandles

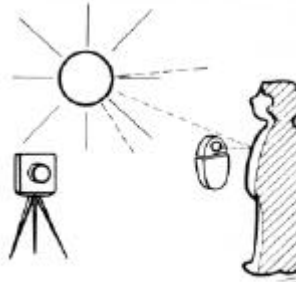
2560 x 10.76 = 27545.6 lux

a. Mount Lumigrid (24) sensor (2) in the same manner as Lumisphere.

b. Set sensitivity value of employed film. Setting is performed in the same manner as for incident light measurement.

c. Point Lumigrid (24) toward 'part of subject to be measured.

d. As close as possible to the subject, measure reflected light from main point of subject. Use adequate care at this time that meter shadow etc. does not interfere.



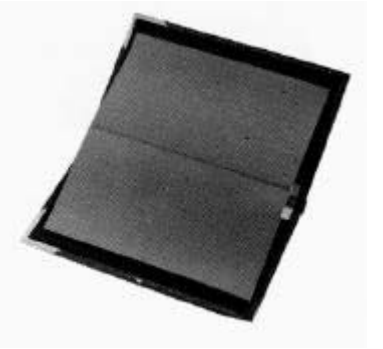
e. Press stopper button (13) and read meter scale footcandle indication (11). However, since footcandles are units of incident light only, this value becomes simply a reference.

f. Transfer indicated value to dial scale (7). Rotate the dial ring (16) and set mark (9).

g. At this time, shutter speed scale (14) and aperture (15) combination becomes the correct exposure.

Note: Do not employ slides for reflected light measurement.

* More accurate results can be obtained for reflected light measurement by using a standard reflectance slide (optional accessory).



Other Operations

1. Exposure Value (EV) number Readout

Reading this exposure value to perform setting becomes convenient for cameras which employ a light value system shutter and aperture combination.

a. Read meter needle (18) foot-candle indication (3)

b. Transfer this number to the dial scale (7). Rotate dial ring (12) and set ▲ scale mark (6). If the High slide is inserted, set the ⏏ mark (9).

c. EV value indicated by EV mark (6) becomes the correct exposure value.

2. Employing Cine Scale

Incident and reflected light measurements during cine photography are performed in the same manner as described previously. However, since the cine scale (12) numerals correspond to cine camera film speed, read the aperture scale (15) indication that pertains to the employed film speed.

Note: Some cine cameras possess faster exposure times due to a narrower rotating shutter angle (angle of light transmitting portion). It is important to know the accurate film speed versus shutter angle value for your camera in order to determine proper exposure. Refer to the camera operating instructions, maker's catalogue, etc. for shutter speed information.

Shutter angle and exposure calculation:

$$T = \frac{\theta}{360 \times R}$$

R = Frames exposed in 1 second
T = Exposure time
θ = Shutter angle

Note: Standard theatrical cine film speed is 24 fps at 1/50 sec. This position is indicated by a red line on the scale.

Using Exposure Multipliers (-2, -1, +1, +2)

Exposure multiplier indications are provided at both sides of the

marks of the dial scale. Use the -1 or -2 mark when desir

ing to cut the exposure to 1!2 of 1!4 and +1 or +2 mark to multiply the exposure by 2 or 4. Set the appropriate mark, instead of the or, to the dial scale value.

EMPLOYING SPECIAL ACCESSORIES

1. Direct Reading Slides

A total of 11 slides are available, all of which may be used together with the Lumisphere and Lumidisc. (Note that they cannot be used with Lumigrid.) The High slide, as mentioned previously, is employed for varying the measuring range in 2 steps (high and low illumination), however, it can also be used for direct reading. The other slides are specialized for direct reading and cannot be used for mode selection.

Shutter speed / Slide No.	1/15	1/30	1/40	1/50	1/60	1/125	1/250	1/500
1	ISO 64	ISO 125	ISO 160	ISO 200	ISO 250			
2	50	100	125	160	200	400		
3	40	80	100	125	160	320		
4	32	64	80	100	125	250		
5	25	50	64	80	100	200	400	
6	20	40	50	64	80	160	320	
7	16	32	40	50	64	125	250	
8		25	32	40	50	100	200	400
9		20	25	32	40	80	160	320
10		16	20	25	32	64	125	250
11			12	16	20	40	80	160
High					12	25	50	100

Note: One set of slides consists of slide numbers 1 - 11 in a case. The High slide can also be used as a direct reading slide.

2. Direct Reading Slide Application

When *photographing, select* slide from the above table according to film sensitivity and shutter speed. Insert slide and perform measurement in the same manner as for incident light. Read directly the aperture value ④ the meter needle ⑱.

* Since it is not necessary to rotate the dial when employing direct reading slides, setting becomes extremely fast and convenient.

MEASUREMENT EXAMPLES WITH VARIOUS SUBJECTS

1. Portrait Photography

There are various kinds of human subject photography. In a case, for example, of a skier against a snowy mountain background, the human subject simply becomes a picture detail and for the purpose of determining the exposure, this cannot be considered portrait photography. In the final analysis, portrait photography is when the human subject is in the center of the picture and the exposure adjusted to him. In addition, camera to subject distance must be considered, whether the picture is to be one person or a group.

Measurement by incident light (Lumisphere installed) displays high effectiveness in portrait photography. Perform measurement as described in the section on Incident Light Measurement. After setting the proper exposure for the human subject, lighting conditions do not present a problem and subject detail is preserved even under back lighting.

2. Typical Scenery

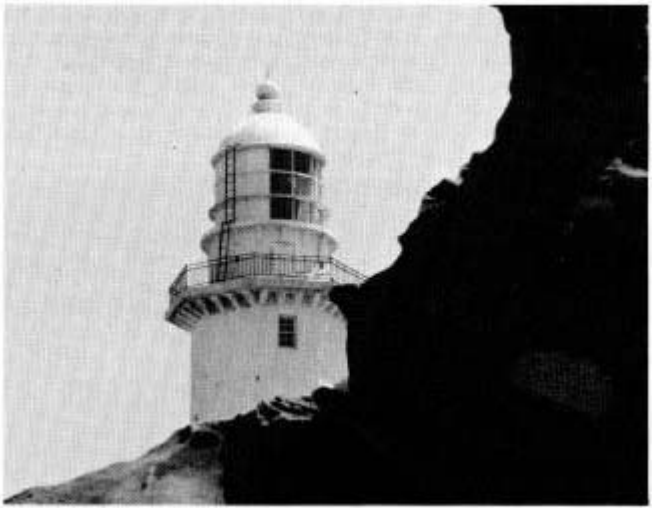
In the case of scenery, measure by using the Lumisphere at the camera position (refer to section on Incident Light Measurement). Although the previously described standard holding method is adequate, if lighting conditions of subject and camera positions are dissimilar, move the meter to a position where conditions are the same type as those of the subject and point in a direction parallel to the camera optical axis. If the subject is shadowed, either move the measuring position to the same type of location or reproduce the same conditions with the hand or other means. Portrayals of buildings etc. can be considered as general middle distance scenery, while main subjects can be treated in the same manner as described in the section on Portrait Photography.

3. Observatorial Scenes

This refers to the situation where a distant object in the subject field forms an important part of the pictured scene.

Examples: Observatories, distant views, etc.

Distant scenes are subject to haze due to atmospheric effects on light and can be easily overexposed. For this reason, first use the Lumisphere and measure by standard method from the camera position. Then point the Lumisphere toward the sun and measure. Determine exposure from the mean of the two obtained values.



Note: To obtain the mean of the two values, perform as follows.
Transfer mean value of the two footcandle indications (aperture scale) to the dial.

Example: If 320(8) footcandles and 80(4) footcandles are obtained, the mean value becomes 160(5.61. In the case of 80(4) and 40(2.8) footcandles, the intermediate becomes the desired value. Consequently, transfer that value to the dial.

Transfer each footcandle value to the dial to obtain exposure. In cases of the same aperture, setting the shutter speed to the average is acceptable. Memo pointer is useful for memorizing the first measured value.

4. Snow Scenes

a. Many cases of problems occur with reflected light measuring methods due to snow surface glare. Using incident light measurement eliminates these concerns. Freshly fallen snow possesses a reflectivity of approximately 73%, while even after several days in urban areas, this declines only to about 60%. Compensation must therefore be performed. Measurement by standard method

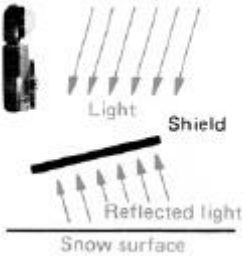
is reduced by $1/\sqrt{2} \sim 1/2$.

Example: If T becomes 1/125 at f 16:
$1/125 \times 1/\sqrt{2} = 1/177 \fallingdotseq 1/200$ or $1/125 \times 1/2 = 1/250$

Note 1 : Reduce as much as possible since overexposed snow can take on a flour-like appearance without luster in the finished photograph.

Note:2: $1/\sqrt{2} \sim 1/2$ compensation amount is based on the reflectivity value of snow. This may vary according to snow quality and soiling.

0Note 3:
In situations with direct or top lighting (sun near zenith), the Lumisphere will detect reflected light from the snow surface. Some means of blocking the light from below becomes required in this case.



b. In some cases, good results can be obtained with reflected light measurement under back light conditions, cloudy snow scenes where glare is less and snow scenes under direct lighting. Install Lumigrid and point light sensor slightly downward to block light from the sky, then from camera position, aim toward subject
and measure. Be sure to set the mark at this time and do not employ slides.

5. Scenes with Side or Back Lighting

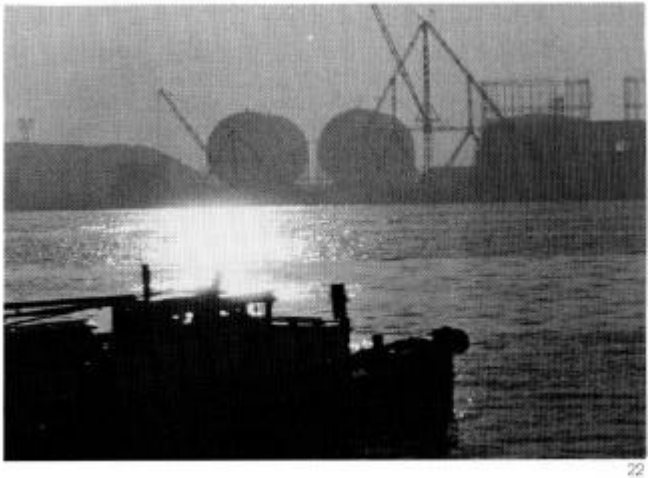
In typical cases of back and side lighting, although the surface of a 3-dimensional subject facing the camera becomes dark, a portion is usually strongly lighted. Even though standard measurement with the Lumisphere can bring out detail of the darker portions, on occasion, the brighter portions can become overexposed and difficult to see. In some instances, this effect can even be enhanced to produce a special photographic composition, but for a generally more attractive result, perform as follows. First use the Lumisphere and measure by standard method, then determine exposure from the mean value (same technique as used for Observatorial Scenes).

6. Silhouette Photography

In situations such as a silhouette of a person, tree or bridge in the foreground against the setting sun and brilliantly shining sky as background, remove slide and point Lumisphere toward the setting

sun to measure (as with Reflected Light Measurement). Then

without inserting High slide, set to mark. In this manner, the foreground becomes silhouetted by underexposing the light source.



APPLICATIONS SUMMARY

1. Special Features of the Studio Deluxe 11

As the Studio Deluxe ll is a high precision measuring instrument, by fully utilizing its capabilities, its special functions can be displayed covering an additionally wide range of applications. Incident light measurement is an extremely practical method in actual photographic situations and is often employed by professional photographers and cinematographers. Since proper exposure can be determined even in cases where errors are easily incurred with reflected light measurement, it is extremely convenient for both color and monochrome.

The Lumisphere displays its optimum value when used for incident light measurement during color or monochrome photography of fleshtones (portrait photography in which fleshtones are considered as the main picture element for determining exposure). Since good or bad quality portrayals can be discerned even by amateurs, fleshtones become the only true standard in color photography. (They can also be given a wider range of artistic expression than visible to the naked eye.)

Well known basic principles form the foundation of the Studio Deluxell, however, plenty of latitude is provided for obtaining special effects. By allowing variations in exposure to be performed, exactly the same reproductions become possible as those learned only from experience. Utilizing the selection of accessories also opens the way to the multitude of applications described in the preceding pages.

2. Illumination Contrast

Light balance measurements are the most important application of the Lumidisc. This consists of measuring the ratio of main light and fill in light in order to perform vital adjustments when photographing an illuminated subject. The photographer is advised to record the data obtained for his particular equipment. This will provide ready reference in the future and allow the same lighting conditions to be reproduced.

When shooting in a studio or similar situation where artificial lighting equipment is used, more attractive results can be produced by making the main and fill in light ratio 4 : 1 - 2 : 1. Also when using reflectors either indoors or outdoors, determine the exposure after measuring the illumination ratio.

Normal sunlight becomes the main light source outdoors, while white or silver reflectors are used to brighten shadow portions of the subject. In this situation, install the Lumidisc, point it toward the sun and read the indicated value. Turn the memo pointer dial and set the pointer 17 at the read value. Next, point the Lumidisc toward the reflector (shield with hand to avoid sunlight) and again read the indicated value. To obtain maximum color effect, this fill in light source should be 1/2 - 1/4 of the main lignt.

An additional theatrical effect can be produced with monochrome by using a higher illumination ratio. It is suggested, for example, to use a ratio between fill in light and sunlight of 1/16 or lower.

If the meter needle deflects beyond scale, use the H slide and as described earlier, multiply the indicated value by 32. Then calculate main and fill in lighting (see section on *Contrast measurement).

After completing light balance adjustment, replace Lumisphere and measure exposure by normal method. At this time, hold the Lumisphere close to the subject to fully detect sunlight and fill in light.

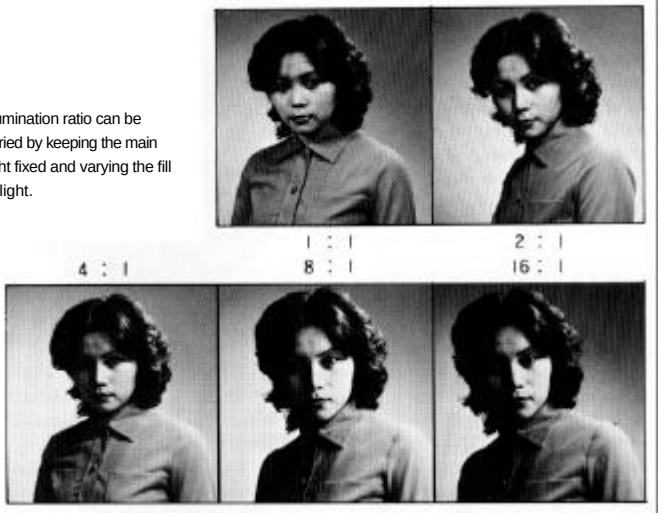
Main light measurement

Fill in light measurement

Use white or silver reflector to brighten shadow portions of subject.

Exposure measurement

Illumination ratio can be varied by keeping the main light fixed and varying the fill in light.



Reflected Light Measurement

Reflected light measurement is employed for the following purposes.

a. Luminance range adjustment.

b. Self-lighted subjects such as neon signs which can only be measured by reflected light method and locations such as show windows where meter cannot be brought into proximity with subject to allow incident light method.

Measurement in these type situations in described below.

1. Luminance range center point

Refers to measuring subject luminance by reflected light method. This luminance varies somewhat according to incident light strength and surface reflectivity of the subject. Incident light becomes measured by taking the standard surface reflection as 18%, from which the exposure value is determined.

To obtain accurate exposures, the Lumisphere is used to measure effective footcandles to determine the Luminance center point.

Shown here is an example of using Lumisphere and by normal measuring method without slide, meter needle indicates 640 footcandles. With film sensitivity of ISO 100, exposure becomes f 45
and shutter speed 1 second. mark at ▲| this time indicates 20.

This 20 indicates the exact center point of the luminance range. In the same condition, install Lumigrid and when standard reflectivity of 18% is measured, this means that the dial scale will indicate 20. When determining exposure by using the Lumisphere or Lumidisc,

the ▲| mark will always indicate the center of luminance range, regardless of whether or not the High slide is inserted.
If the measured value is set to the dial scale ▲| mark and the ▲ mark dose not reach the scale, reflected light measurement with the Lumigrid cannot be performed due to insufficient incident light strength. In other words, if the incident light is less than 160 footcandles, reflected light measurement cannot be performed with the Lumigrid.

b. Hold meter about 15cm from the subject, point Lumigrid to each surface of the subject and read the footcandle scale value.

c. To determine the luminance range, it is sufficient to divide the highest meter indication by the lowest. For example, if the highest value is 80 and the lowest 5, the luminance range becomes 80/5 = 16/1 or 16 : 1.

Luminance range measurement

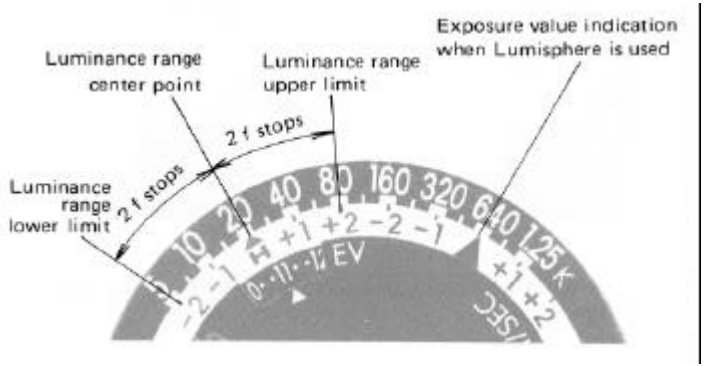
3. To obtain superior color photographs, determine upper and lower limits.

a. Adequate color photographs can be obtained with typical color film if within the subject luminance distribution, the maximum is less than 4 times the center point and minimum more than 1 /4 times (i.e.: overall luminance range becomes less than 16 : 1).

b. With a luminance center point of 20, if the measured maximum luminance is higher than 80 (center point 20 x 4 = 80), color of that surface will become faded in the photograph. Consequently, a slight reduction of incident light to this portion becomes required.

c. Conversely, a portion with a measured minimum luminance less than 5 (center point 20 / 4 = 5) requires increased illumination in order to obtain an acceptable color photograph.

The Studio Deluxe indicates normal color photograph luminance range limits corresponding to 2 f stops left and right of the luminance range center point.


Exposure value indication when Lumisphere is used
Luminance range center point
Luminance range upper limit
2 f stops
Luminance range lower limit
2 f stops
10 20 40 80 160 320 640 1250
+1 +2 -2 -1
EV
+1 +2

4. Illumination Adjustment

The Studio Deluxe possesses an array of functions for the performance of illumination adjustments which were nearly unknown in earlier instruments. It allows the shooting site to be set up quickly and accurately. Described here are set up procedure and 29

examples to provide full control over movie scenes. It would not be erroneous to also apply these to still photos.

Stage 1

Determine overall lighting strength.

a. Set meter to ISO 100 (see film sensitivity intermediate values).

b. Set 24 red line of cine speed scale to F/5.6.

c. At this time, ▲ mark indication on dial scale becomes slightly lower than 640 (footcandles). If this is taken as the meter scale position, a value of 500 footcandles (lower than 640 footcandles) becomes the required lighting strength (see meter intermediate scale values).

Stage 2
Key light setting

a. Turn on key light (main light) and determine direction required for subject illumination.

b. Without installing slide, hold meter at the subject position, point Lumisphere toward camera and set stopper button to released position.

c. Adjust main light intensity or distance until meter indicates 400. The indication can then be increased to the required 500 footcandles (determined in Stage 1c) by applying fill in light.

Stage 3
Adjust illumination contrast

a. Install Lumidisc in place of Lumisphere.

b. Measure key light (indication should be 400 footcandles).

c. Turn on fill in light.

d. As described in section on outdoors Illumination Contrast Adjustment, adjust fill in light to obtain suitable illumination contrast. (For a contrast ratio of 2 : 1, the fill in light indication must be 200 footcandles.) Lighting from back affects contrast only slightly.

Adjust luminance range

a. Install Lumisphere.

b. Hold meter at subject position, point Lumisphere toward camera and read needle indication. With all lights turned on, adjust main light so that indication becomes 500 footcandles.

c. Set mark to 500 and read

value becomes 16 to indicate luminance range center point. If by experience the required results can be obtained with a luminance range of 16 to 1, a maximum luminance indication of 64 (center point 16 x 4 = 64) becomes the upper limit for desired color reproduction. In this case, the minimum limit becomes 4 (center point 16 = 4 = 4). This means that attractive color reproduction cannot be obtained unless the subject luminance distribution is within 4 ^- 64.

d. Exchange Lumisphere for Lumigrid and check if there are any locations on the subject brighter than 64 or dimmer than 4.

Stage 5

Determine correct exposure

Although above Stage 4b includes an exposure value measurement using the Lumisphere, perform correct exposure measurement as a final check. With the illumination controlled as described, this should accurately become F/5.6 1/50 sec. This 5 stage procedure allows full control of all lighting elements.

Closeups

It is essential to increase the exposure value when the subject is closer to the camera than 10 times the camera focal distance. An example of this type of case is with a camera lens focal distance to 50mm and a subject distance of 40cm. The reason for this is the increased image magnification as the subject approaches the camera. When light from the subject passes through the lens and becomes focused on the film, the following relationship exists among film plane illumination, subject brightness and image magnification.

$$E = \frac{a \cdot \pi L}{4 \cdot F^2} \cdot \frac{1}{(M+1)^2}$$

E: Film plane illumination
L: Subject luminance
M: Image magnification
F: F number
π: circular constant
a: constant

As can be noted from the above formula, if the subject luminance is fixed and the magnification changes, the film plane brightness (illumination) varies in the inverse proportion $(M + 1)^2$. With a large subject distance, M is small and this effect becomes nearly absent, but as the subject distance decreases, M becomes larger. In an actual photographic example, with a magnification M of 1, film plane brightness becomes $(M + 1)^2$ or 4. This is 1/4th that of a subject distance at infinity and exposure must be increased 4 times. When the measured exposure value is 1/60 sec shutter speed, this must be compensated to 1/15 sec (1/60 x 4 = 1/15). In closeup photography, $(M + 1)^2$ is referred to as the compensation factor.

Measuring Method

Hold meter as close as possible to the subject and point Lumisphere toward the camera. If light source is very close to the subject, temporarily remove the subject and hold the Lumisphere in the subject position. The light then striking the Lumisphere becomes exactly the same as that illuminating the subject. To obtain exposure compensation for closeup:

1. Determine exposure by normal incident light method. 2. Measure subject and image sizes (groundglass).
3. If the image is larger than the subject, it is enlarged, while a smaller image is compressed. Divide the larger value by the smaller value.
4. Obtain compensation factor from Table 1.
5. Apply compensation factor to measured exposure value to produce compensated exposure value.

Compensation factor = $(M + 1)^2$

Compression		Enlargement .	
Subject to image ratio	Compensation factor	Subject to image ratio	Compensation Factor
20 : 1	1.10	1 : 1	4
19 : 1	1.11	1 : 1.25	5
18 : 1	1.11	1 : 1.50	6
17 : 1	1.12	1 : 1.75	7.5
16 : 1	1.13	1 : 2	9
15 : 1	1.14	1 : 2.25	10.5
14 : 1	1.15	1 : 2.5	12
13 : 1	1.16	1 : 2.75	14
12 : 1	1.17	1 : 3	16
11 : 1	1.19	1 : 3.5	20
10 : 1	1.21	1 : 4	25
9 : 1	1.24	1 : 4.5	30
8 : 1	1.27	1 : 5	36
7 : 1	1.31	1 : 6	49
6 : 1	1.36	1 : 7	64
5 : 1	1.44	1 : 8	81
4.5 : 1	1.50	1 : 9	100
4 : 1	1.56	1 : 10	121
3.5 : 1	1.65	1 : 1 1	144
3 : 1	1.78	1 : 12	169
2.75: 1	1.86	1 : 13	196
2.5 : 1	1.96	1 : 14	225
2.25: 1	2.09	1 : 15	256
2 : 1	2.25	1 :16	289
1 .75 : 1	2.47	1 : 17	324
1.5 : 1	2.78	1 :18	361
1 .25 : 1	3.24	1 : 19	400
1 : 1	4.00	1 : 20	441

HANDLING CAUTIONS

Since the Studio Deluxe II is a high precision instrument, use ample care in regard to the following points.

Avoid dropping or subjecting it to strong shock.

Do not store in high temperature or high humidity locations.

Do not store in areas subject to magnetic fields or where insect repellants are located (metal cabinets, clothing dressers, etc.).

Keep Lumisphere and Lumidisc clean and protect from scratches. If severely soiled, these can be washed in a lukewarm solution of mild detergent. Rinse and dry thoroughly.

In event service is required, contact the nearest authorized service agency. If necessary to ship the meter, be sure to surround it with at least 3cm (1-1/2") thick insulating material and pack in a sturdy, crush resistant package.

KODAK PLUS-X Reversal Film 7265

KODAK PLUS-X Reversal Film 7265 (16 mm) is a medium-speed, panchromatic black-and-white film suitable for general exterior photography. It has a high degree of sharpness, good contrast, and tonal gradation. It can also be used in interior photography with ample artificial illumination.

BASE

KODAK PLUS-X Reversal Film 7265 has a grey acetate safety base. The back side of the base contains an antistatic layer with a carnauba wax lubricant.

DARKROOM RECOMMENDATIONS

Reversal Processing -

All processing operations should be carried out in total darkness until development is 50 percent completed. If necessary, the film can be examined using a KODAK 3 Safelight Filter / dark green, with a 15-watt bulb, no closer to the film than 1.2 meters (4 feet).

Negative Processing -

No safelight is recommended until after the stop bath. Unprocessed films must be handled in total darkness.

STORAGE

Store unexposed film at 13°C (55°F) or lower. For extended storage, store at -18°C (0°F) or lower. Process exposed film promptly. Store processed film according to the recommendations in ANSI/PIMA IT9.11-1998: for medium-term storage (minimum of ten years), store at 10°C (50°F) or lower at a relative humidity of 20 to 30 percent; for extended-term storage (for preservation of material having permanent value), store at 2°C (35°F) or lower at a relative humidity of 20 to 30 percent. For active use, store at 25°C (77°F) or lower, at a relative humidity of 50 +/- 5 percent. This relates to optimized film handling rather than preservation; static, dust-attraction and curl-related problems are generally minimized at the higher relative humidity. After usage, the film should be returned to the appropriate medium- or long-term storage conditions as soon as possible.

For more information about medium- and long-term storage, see ANSI/PIMA IT9.11-1998, SMPTE RP131-2002, and KODAK Publications No. H-1, *KODAK Motion Picture Film,* available online at **http://www.kodak.com/US/en/motion/support/h1**, and No. H-23, *The Book of Film Care*.

EXPOSURE INDEXES

For recommended reversal processing:

Tungsten (3200K) - 80	Daylight - 100

Use these indexes with incident- or reflected-light exposure meters and cameras marked for ISO or ASA speeds or exposure indexes. These indexes apply for meter readings of average subjects made from the camera position or for readings made from a gray card of 18-percent reflectance held close to and in front of the subject. For unusually light- or dark-colored subjects, decrease or increase the exposure indicated by the meter accordingly.

For negative processing (gamma=1.0) in a typical motion picture negative developer, use the following exposure indexes:

Tungsten (3200K) - 20	Daylight - 25

When exposing in super 8 cameras through a KODAK WRATTEN Gelatin Filter No. 85, the effective speed is reduced to 64 for daylight. In automatic cameras, due to the cartridge speed and filter notching system, the film will be exposed as follows:

Daylight (no filter) - 100

Daylight (with filter) - 64

Tungsten (without filter) - 80

The film latitude will provide satisfactory results at these exposure levels.

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EXPOSURE TABLE - TUNGSTEN LIGHT

This table is based on EI-80 (tungsten) and reversal processing with a shutter speed of approximately1/50 second, 24 frames per second (fps), and 180-degree shutter opening:

Lens Aperture	*f*/1.4	*f*/2	*f*/2.8	*f*/4	*f*/5.6	*f*/8
Footcandles Required[1]	32	64	125	250	500	1000

[1] At 18 frames per second, use 3/4 of the footcandles (fc) shown. When the film is used as a negative material, the values specified should be doubled.

Lighting Contrast -

The recommended ratio of key-light-plus-fill-light to fill light is 2:1 or 3:1. However, you may use 4:1 or greater when a particular look is desired.

FILTER FACTORS

KODAK WRATTEN Filter No.	3	8	11	12	15	21	23A	25	29	96[1]
Daylight	1.5	2.0	4	2.0	2.5	3	5	10	40	8

[1] For use in bright sunlight to reduce the exposure without modifying color rendering or depth of field. This filter which has a neutral density of 0.90 provides a reduction in exposure equivalent of 3 full stops.

RECIPROCITY CHARACTERISTICS

(Recommended Reversal Process at 76°F (24.4°C))

You do not need to make any exposure adjustments for exposure times form 1/1,000 to 1 second. If your exposure is in the 1/10,000 second range, it is recommended that you increase your exposure by ½ stop.

REVERSAL PROCESSING

KODAK B&W Reversal Process

This film should be processed with KODAK B&W Reversal Process Kit Chemicals or with solutions prepared according to the formulas presented in KODAK Publication No.H-24.15, *Manual for Processing KODAK Motion Picture Films, Module 15*.

Note: KODAK B&W Reversal First Developer and Replenisher (D-94A) and KODAK B&W Reversal Bleach and Replenisher (R-10) should be used with this film.

The recommended starting points for processing times and temperatures are shown in the table below. Actual processing times may differ from the ones shown because of machine design variables, such as film transport speed, degree of solution agitation, amount of solution carry-over, etc.

Process Step	Time 24.4°C (76°F)
First Developer KODAK B&W Reversal First Developer and Replenisher (D-94A)	60 sec
Wash	30 sec
KODAK B&W Reversal Bleach and Replenisher (R-10)	60 sec
Wash	30 sec
Clearing Bath	30 sec
Wash	30 sec
Re-exposure	800 footcandle seconds
Second Developer KODAK B&W Reversal Developer and Replenisher (D-95)	30 sec
Wash	30 sec
Fixer	30 sec
Wash	2 min

Notice: Observe precautionary information on product labels and on the Material Safety Data Sheets.

NEGATIVE PROCESSING

Although designed for reversal processing, this film is capable of yielding useful negative images or conventional quality and contrast if developed in a developer such as KODAK Developer D-96 and them fixed. When a developer of this type is used, the speed is not more than 1-½ to 1-⅔ that is normally obtained in reversal processing (using KODAK B&W Reversal First Developer and Replenisher (D-94A)).

If negatives are required, it is preferable to use films designed for that purpose.

IDENTIFICATION

After processing, the product code numbers 7265, emulsion and roll number identification, emulsion letter designator EC, and KEYKODE number are visible along the length of the film.

IMAGE STRUCTURE

The modulation-transfer and diffuse rms granularity curves were generated from samples of 7265 Film exposed with tungsten light and processed in the recommended reversal process at 24.4°C (76°F). For more information on image-structure characteristics, see KODAK Publication No. H-1, *KODAK Motion Picture Film* available on line at **http://www.kodak.com/US/en/motion/support/h1.**

MTF

The “perceived” sharpness of any film depends on various components of the motion picture production system.The camera and projector lenses and film printers, among other factors, all play a role. But the specific sharpness of a film can be measured and charted in the Modulation Transfer Curve.

rms Granularity

Refer to curve.

Read with a microdensitometer using a 48-micrometer aperture.

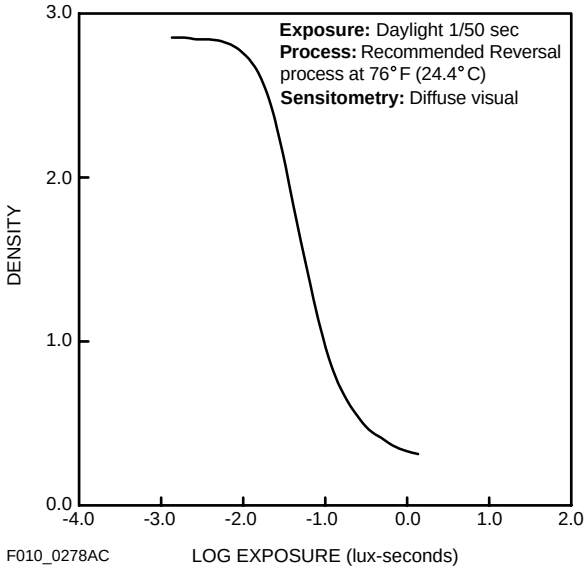
The “perception” of the graininess of any film is highly dependent on scene content, complexity, color, and density. Other factors, such as film age, processing, exposure conditions, and telecine transfer may also have significant effects.

AVAILABLE ROLL LENGTHS

For information on film roll lengths, check Kodak's Motion Picture Film product catalog or see a Kodak sales representative in your country.

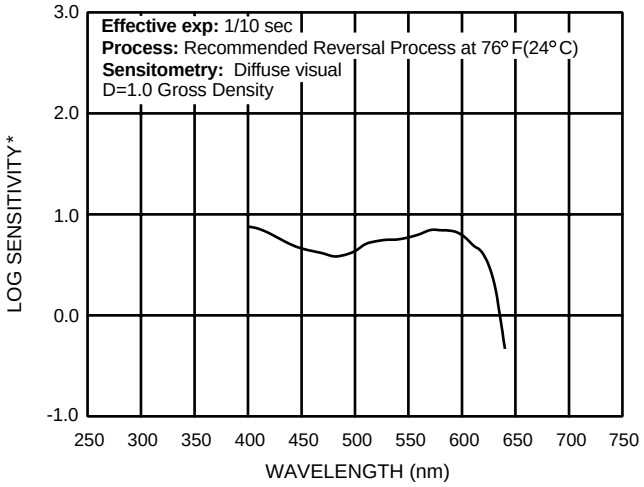
CURVES

Characteristic Curve



F010_0278AC

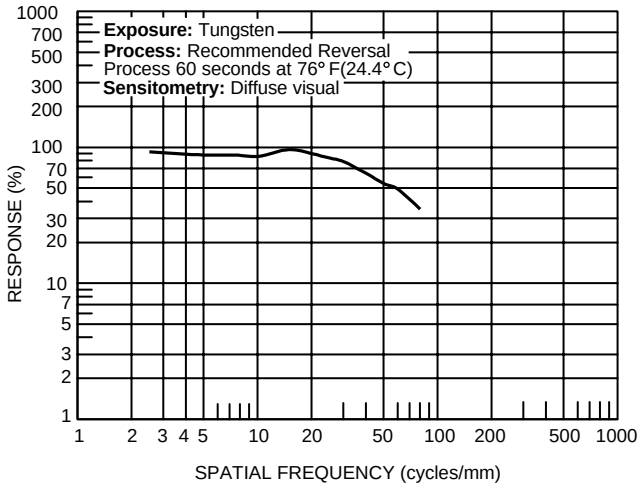
Spectral Sensitivity Curve



*Sensitivity = reciprocal of exposure (erg/cm^2) required to produce specified density

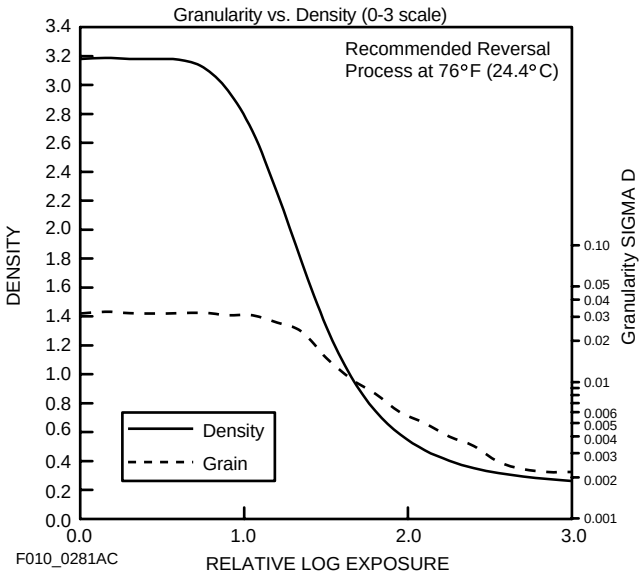
F010_0280AC

Modulation Transfer Function Curve



F010_0279AC

rms Granularity Curve



F010_0281AC

NOTICE: The sensitometric curves and data in this publication represent product tested under the conditions of exposure and processing specified. They are representative of production coatings, and therefore do not apply directly to a particular box or roll of photographic material. They do not represent standards or specifications that must be met by Eastman Kodak Company. The company reserves the right to change and improve product characteristics at any time.

MORE INFORMATION

Outside the United States and Canada, please contact your Kodak representative.

You can also visit our web site at **www.kodak.com/go/motion** for further information. You may want to bookmark our location so you can find us easily the next time.

Films	*Cinematographer's Field Guide* KODAK Publication No. H-2
Image Structure	*KODAK Motion Picture Film* KODAK Publication No. H-1
Specification Numbers	*Cinematographer's Field Guide* KODAK Publication No. H-2
Storage	*KODAK Motion Picture Film* KODAK Publication No. H-1 *The Book of Film Care* KODAK Publication No. H-23
LAD	*LAD—Laboratory Aim Density* KODAK Publication No. H-61
Transfer	*KODAK Telecine Analysis Film User's Guide* KODAK Publication No. H-822 *KODAK Telecine Exposure Calibration Film User's Guide* KODAK Publication No. H-807

KODAK TRI-X Reversal Film 7266

We are committed to black & white film—improvements to our family of reversal films prove it. New KODAK TRI-X Reversal Film 7266 offers finer grain and increased sharpness, and includes EASTMAN KEYKODE Numbers for easy cross-reference of shots in minutes, not hours. Reduced static support allows for a cleaner image throughout the filmmaking process. And because our new films do not require processing in a bleach containing heavy metals, they are easier on the environment. Our improved films provide the rich blacks and high contrast you have come to expect from KODAK Black & White reversal films.

KODAK TRI-X Reversal Film 7266 (16 mm) is a high-speed, panchromatic black-and-white film with an antihalation undercoat that makes it suitable for general interior photography with artificial light. It can also be used in daylight and is particularly useful for sports pictures taken at regular speed or slow motion in weak light (overcast sky or late in the day). This film is characterized by excellent tonal gradation and sharpness.

When processed as a reversal film, the resulting positive can be used for projection or for duplication. If processed as a negative material by conventional methods, the film will yield satisfactory results, although there will be some loss in speed and an increase in granularity.

BASE

KODAK TRI-X Reversal Film 7266 has a grey acetate safety base with an additional anti-halation undercoat. The back side of the base contains an anti-static layer with a carnauba wax lubricant.

DARKROOM RECOMMENDATIONS

Reversal Processing

All processing operations should be carried out in total darkness until the bleaching step has been completed. If necessary, the film can be examined (for a few seconds only) after development is 50 percent complete. Use a KODAK 3 Safelight Filter / dark green, with a 15-watt bulb, no closer to the film than 1.2 metres (4 feet). Following bleaching, normal room lighting can be used.

Negative Processing

No safelight is recommended until after the stop bath. Unprocessed films must be handled in total darkness.

STORAGE

Store unexposed film at 13°C (55°F) or lower. For extended storage, store at -18°C (0°F) or lower. Process exposed film promptly. Store processed film according to the recommendations in ANSI/PIMA IT9.11-1998: for medium-term storage (minimum of ten years), store at 10°C (50°F) or lower at a relative humidity of 20 to 30 percent; for extended-term storage (for preservation of material having permanent value), store at 2°C (35°F) or lower at a relative humidity of 20 to 30 percent. For active use, store at 25°C (77°F) or lower, at a relative humidity of 50 +/- 5 percent. This relates to optimized film handling rather than preservation; static, dust-attraction and curl-related problems are generally minimized at the higher relative humidity. After usage, the film should be returned to the appropriate medium- or long-term storage conditions as soon as possible.

For more information about medium- and long-term storage, see ANSI/PIMA IT9.11-1998, SMPTE RP131-2002, and KODAK Publications No. H-1, *KODAK Motion Picture Film* available online at **http://www.kodak.com/US/en/motion/support/h1**, and No. H-23, *The Book of Film Care*.

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EXPOSURE INDEXES

Tungsten (3200K) - 160 Daylight - 200[1]

Use these indexes with incident- or reflected-light exposure meters and cameras marked for ISO or ASA speeds or exposure indexes. These indexes apply for meter readings of average subjects made from the camera position or for readings made from a gray card of 18-percent reflectance held close to and in front of the subject. For unusually light- or dark-colored subjects, decrease or increase the exposure indicated by the meter accordingly.

EXPOSURE TABLE - TUNGSTEN LIGHT

At 24 frames per second (fps), 170-degree shutter opening:

Lens Aperture	*f*/1.4	*f*/2	*f*/2.8	*f*/4	*f*/5.6	*f*/8
Footcandles Required [1]	16	32	64	125	250	500

[1] At 18 frames per second, use 3/4 of the footcandles (fc) shown. When the film is used as a negative material, the values specified should be doubled.

Lighting Contrast -

The recommended ratio of key-light-plus-fill-light to fill light is 2:1 or 3:1. However, you may use 4:1 or greater when a particular look is desired.

FILTER FACTORS

KODAK WRATTEN Filter No.	3	8	8N5	12	15	21	23A	25	29	96[1]
Daylight	1.5	2	4	2	2.5	3	5	10	40	8

[1]For use in bright sunlight to reduce the exposure without modifying color rendering or depth of field. This filter which has a neutral density of 0.90 provides a reduction in exposure equivalent of 3 full stops.

1.Super 8 automatic cameras will expose the film at ASA 160 due to the ANSI standard cartridge.

RECIPROCITY CHARACTERISTICS

You do not need to make any exposure adjustments for exposure times from 1/1,000 to 1 second. If your exposure is in the 1/10,000 second range, it is recommended that you increase your exposure by ½ stop.

REVERSAL PROCESSING

KODAK B&W Reversal Process

This film should be processed with KODAK B&W Reversal Process Kit Chemicals or with solutions prepared according to the formulas presented in KODAK Publication No.H-24.15, *Manual for Processing KODAK Motion Picture Films, Module 15*.

Note: KODAK B&W Reversal First Developer and Replenisher (D-94A) and KODAK B&W Reversal Bleach and Replenisher (R-10) should be used with this film.

The recommended starting points for processing times and temperatures are shown in the table below. Actual processing times may differ from the ones shown because of machine design variables, such as film transport speed, degree of solution agitation, amount of solution carry-over, etc.

Process Step	Time 24.4°C (76°F)
First Developer KODAK B&W Reversal First Developer and Replenisher (D-94A)	60 sec
Wash	30 sec
KODAK B&W Reversal Bleach and Replenisher (R-10)	60 sec
Wash	30 sec
Clearing Bath	30 sec
Wash	30 sec
Re-exposure	800 footcandle seconds
Second Developer KODAK B&W Reversal Developer and Replenisher (D-95)	30 sec
Wash	30 sec
Fixer	30 sec
Wash	2 min

Notice: Observe precautionary information on product labels and on the Material Safety Data Sheets.

IDENTIFICATION

After processing, the product code numbers 7266, emulsion and roll number identification, emulsion letter designator ED, and KEYKODE number are visible along the length of the film.

IMAGE STRUCTURE

The modulation-transfer curves and the diffuse rms granularity were generated from samples of 7266 Film exposed with tungsten light and processed in the recommended reversal process at 24.4°C (76°F). For more information on image-structure characteristics, see KODAK Publication No. H-1, *KODAK Professional Motion Picture Film*.

MTF

The “perceived” sharpness of any film depends on various components of the motion picture production system.The camera and projector lenses and film printers, among other factors, all play a role. But the specific sharpness of a film can be measured and charted in the Modulation Transfer Curve.

rms Granularity

Refer to curve.

Read with a microdensitometer using a 48-micrometer aperture.

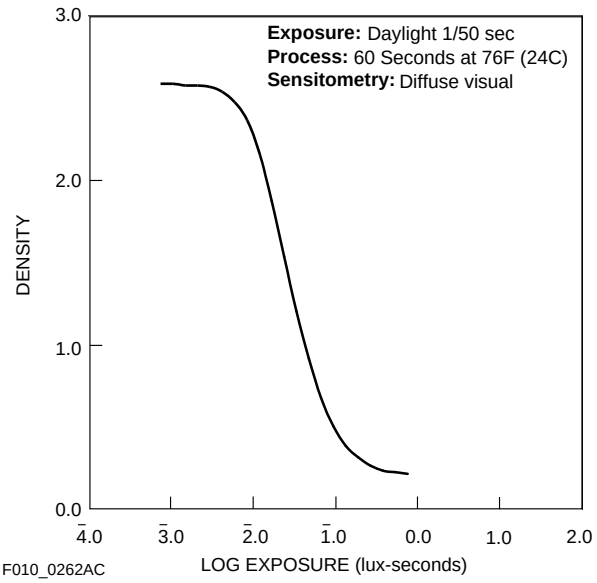
The “perception” of the graininess of any film is highly dependent on scene content, complexity, color, and density. Other factors, such as film age, processing, exposure conditions, and telecine transfer may also have significant effects.

AVAILABLE ROLL LENGTHS

For information on film roll lengths, check Kodak's Motion Picture Films product catalog or see a Kodak sales representative in your country.

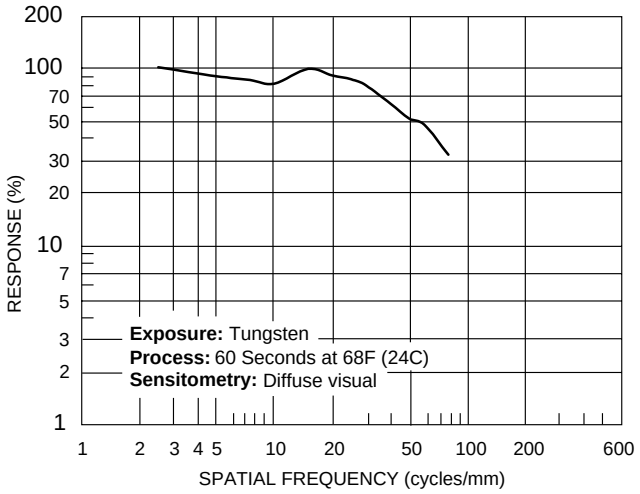
CURVES

Characteristic Curve



F010_0262AC

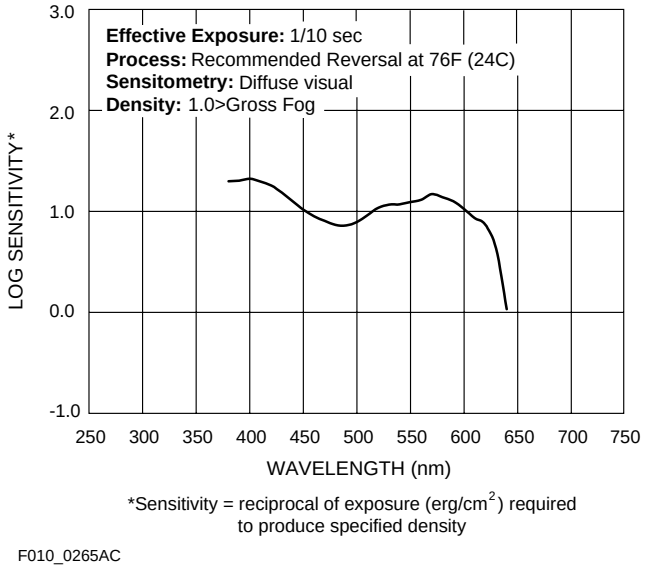
Modulation Transfer Function Curve



F010_0263AC

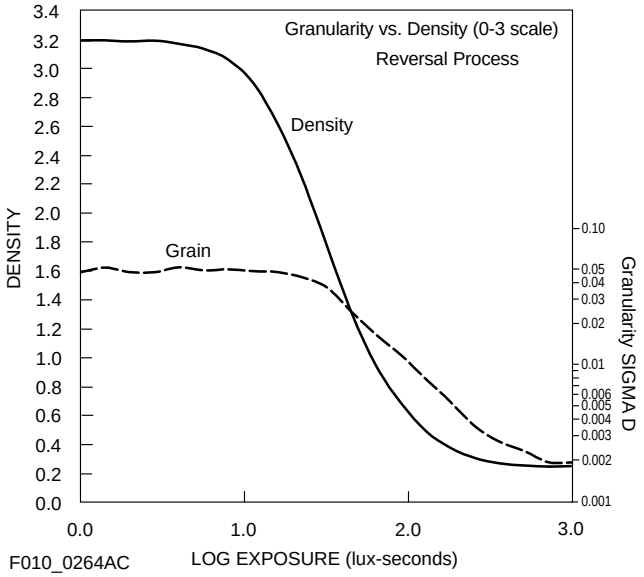
MTF curve—This graph shows a measure of the visual sharpness of the film. The x-axis, “Spatial Frequency”, refers to the number of sine waves per millimeter that can be resolved. The y-axis, “Response”, corresponds to film sharpness. The longer and flatter the line, the more sine waves per millimeter that can be resolved with high degree of sharpness, and the sharper the film is.

Spectral Sensitivity Curve



Spectral Sensitivity Curve—These curves depict the sensitivity of this film to the spectrum of light.

rms Granularity Curve



Note: Sensitometric and Diffuse RMS Granularity curves are produced on different equipment. A slight variation in curve shape may be noticed.

To find the rms Granularity value for a given density, find the density on the left vertical scale and follow horizontally to the characteristic curve and then go vertically (up or down) to the granularity curve. At that point, follow horizontally to the Granularity Sigma D scale on the right. Read the number and multiply by 1000 for the rms value. Note: This curve represents granularity based on modified measuring techniques.

NOTICE: The sensitometric curves and data in this publication represent product tested under the conditions of exposure and processing specified. They are representative of production coatings, and therefore do not apply directly to a particular box or roll of photographic material. They do not represent standards or specifications that must be met by Eastman Kodak Company. The company reserves the right to change and improve product characteristics at any time.

MORE INFORMATION

Outside the United States and Canada, please contact your Kodak representative.

You can also visit our web site at **www.kodak.com/go/motion** for further information. You may want to bookmark our location so you can find us easily the next time.

Films	*Cinematographer's Field Guide* KODAK Publication No. H-2
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Luna-Pro

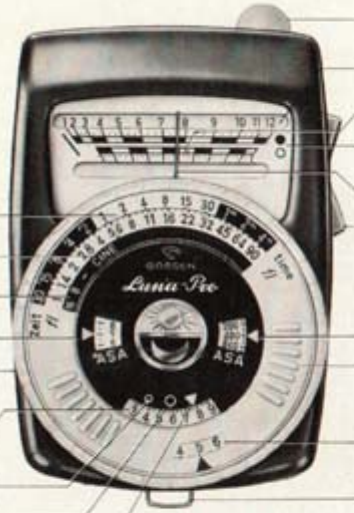
Electronic

System Exposure Meter

Operating Instructions and Exposure Manual

Luna-PRO Operating Parts and Scales

Keep this page folded out when reading instructions, so that you can easily identify parts and scales.



Exposure Time Scale ①
(shutter speeds)

Aperture Scale ②
(f-stops)

Cine Scale ③
(frames per second)

ASA Degrees ④

Computer Ring for setting ⑤
the indicator reading on
the yellow transfer scale

Transfer Scale ⑥

Green Ring Index for 7.5° ⑦
measurement (with "spot
meter" attachment only)

Red Ring Index ⑧
for 15° measurement
(with "spot meter"
attachment only)

⑨ **Yellow Index for regular 30° measurement** without "spot meter" attachment, and for incident light measurement

⑩ Converter Slide with spherical diffuser for incident light measurement

⑪ Indicator Scale

⑫ Red Check Mark for battery testing only

⑬ Scale Divisions
upper ● for values 1 to 12
lower ○ for values 12 to 22

⑭ Indicator Needle

⑮ Range Selector
forward = low range
backward = bright range

⑯ ASA Exposure Index Values

⑰ Film Speed Setting Disk

⑱ Scale for shutters calibrated in EV (Exposure Values)

⑲ Eyelet for neckstrap

⑳ Diagram showing correct position of the 2 batteries

㉑ Battery Chamber

㉒ Ridged Slide for battery testing

㉓ Table of Footcandle (Lux) equivalents

㉔ Zero Adjustment Screw

Basic Operating Instructions

Setting the film speed

Look up the ASA Exposure Index of the film in use (you will find it on the film box or film instruction sheet) and turn the plexiglass film-speed setting disc (17) by the raised bars, until the ASA Index number (or ASA Degree) is lined up against the triangular white marker in the respective window.

You will find a detailed ASA film-speed table in the technical appendix on page 25.

Reflected Light Measurement: Move the converter slide (10) all the way to the right; this uncovers the round window. The Luna-PRO is ready when the converter slide has clicked into position. Point the Luna-PRO toward the subject, as indicated by the arrow in the illustration.

Incident Light Measurement: Move the converter slide (10) so that the spherical diffuser is centered over the round window. The Luna-PRO is ready when the converter slide has clicked into position. The Luna-PRO is pointed from the subject towards the camera, as indicated by the arrow in the illustration.

Light Measurement – (basic steps)

Press the range selector (15) **backward** and release it when the indicator needle (14) stops moving. This locks the reading in for convenient reference.

If the indicator needle is deflected only slightly (below 12 on the scale), take a new reading by pressing the range selector **forward.** You have now switched the Luna-PRO to the low light range. Wait again until the needle stops, and lock the reading in by releasing the selector.

If the light is so poor that you cannot observe the movement of the needle, simply hold down the selector for several seconds. After releasing it, you have locked in the correct reading and can take the Luna-PRO to better light, or use a flashlight to read the scale.

As you press the selector forward, the values 1 to 12 appear in the upper frame, and the upper scale divisions apply; when you press the selector backward, the values 12 to 22 appear in the lower frame to which the adjacent lower scale divisions apply. When you release the selector, only the scale values applicable to the measuring range which you just selected, remain visible.

Thus, the Luna-PRO always shows the correct scale!

After taking the measurement, turn the computer ring (5) until the obtained reading is set at the triangular yellow index (9) of the transfer scale (6). The green and red ring indexes apply only for measurements with the Variable Angle "spot meter" attachment. See page 17.

The Luna-PRO now gives you complete exposure information in combinations of f-stops and exposure times (2 and 1), EV settings (18) or frames per second for motion picture cameras (3).

You will find additional information about all scale values on pages 24 and 25.

Light Measurement – more specific

In **reflected light measurement,** the Luna-PRO measures the light reflected by objects within a certain area. The resultant reading, therefore, depends not only on the intensity of the illumination, but also on the color and brightness of the objects themselves. Thus, under identical illumination, the indicator needle will be deflected less by dark objects than by bright ones. In an over-all measurement the Luna-PRO will read the average brightness of all subjects in a scene.

If the scene contains strong contrasts in brightness or color, it is preferable to measure that part of the scene which requires the most accurate exposure. For black-and-white or color negative films, this is usually a darker area which is to show details in the final print; for reversal color (slide or movie) films, however, the lighter areas are usually favored.

To measure the important areas, get closer to the subject but not so close that your own shadow or that of the Luna-PRO falls on the subject. This method is called: **close-up reading.**

In **incident light measurement** – from the subject towards the camera – the Luna-PRO measures all the light falling on that part of the subject which faces the camera. Naturally, neither the color nor the brightness of the subject itself is considered by this measurement.

With inaccessible subjects, take the incident light measurement at a substitute spot which receives the same illumination as the subject. However, instead of pointing the Luna-PRO towards the camera, you point it parallel to an imaginary line from the object to the camera.

Incident light measurement at a substitute spot of equal illumination is also convenient for many regular outdoor scenes. Frequently, the spot where you stand with the camera receives the same illumination as the scene which you intend to photograph, in which case you merely do "about face" with your Luna-PRO and measure the light exactly opposite to the direction of the camera.

More about this on page 8–11.

Testing the Batteries

With normal use of the Luna-PRO, the Mallory mercury batteries supplied with it have a life of about two years.

It is advisable to check the condition of the batteries from time to time, as follows: Push the ridged slide (22) in the direction of the arrow **without pressing the range selector (15).** During the battery test, the indicator needle (14) should point to the red check mark (12). Otherwise, fresh batteries must be used.

To replace the batteries, unscrew the cover of the battery chamber (21) – a coin will be useful for this. Make sure you use only **Mallory PX 13** batteries in your Luna-PRO.

After inserting fresh batteries, immediately make the battery test described above.

Mallory PX 13 mercury batteries are available at camera shops, or send $ 1.50 for 2 batteries (incl. postage) to Kling Photo Corporation, P.O.Box 1060, Woodside, N.Y. 11377.

Testing Zero Position

To test the zero position of the indicator needle, first remove both batteries from the Luna-PRO. Then press the range selector (15) forward or backward. The indicator needle should now rest on the check line to the left of the scale divisions (13).

To adjust the indicator needle to the zero check line, turn the zero adjustment screw (24) on the underside of the Luna-PRO, **while holding down the range selector (15).**

Thinking and Measuring

One thing the Luna-PRO can not do: It cannot think for you! Even the most advanced "electronic brain" is helpless without the scientist who phrases his problems so that they can be processed by the computer. The Luna-PRO, too, answers exposure questions all the more precisely, if you ask more carefully! You will find this quite easy once you become familiar with your Luna-PRO.

Above all, you must know how your Luna-PRO sees the world that you want to get on your film. This world is made up of many parts, which differ considerably in size, color and brightness. In the case of **reflected light measurement**, the Luna-PRO collects, within a certain angle, the light which is reflected from these many individual parts of the scene; it adds up all the light and strikes an average for which it indicates a suitable exposure time. And, normally, the exposure indicated in this manner is perfectly correct. (Reflected Light Measurement, see also pages 3 and 5.)

Anything unusual which you – as attentive (!) observer – will easily notice, may not be "seen" by the Luna-PRO in quite the same manner. If the scene includes a large very bright area – far from the "average" that the Luna-PRO would normally calculate with – it

will indicate a shorter exposure time than it would for a large very dark area. But you want to see the very light, or very dark area in the finished picture again as "very light" or "very dark" – not as "grey"! What to do? Your judgment has to guide the Luna-PRO: If there are extensive very bright or very dark areas in the scene, steer the Luna-PRO away from them and take the measurement from the "average" parts of the scene. Keep in mind the

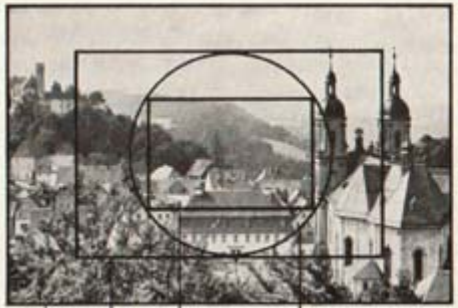
Measuring Area of the Luna-PRO

You can see in the viewfinder, or on the groundglass of your camera exactly what will be included in your picture. The Luna-PRO cannot orient itself! Of course, you'll want to know what parts of a scene are included in a **reflected light measurement.**

The camera, with your help, selects its "rectangle" or "square"; the Luna-PRO covers a measuring "circle". Whatever lies outside of these variously shaped areas remains unseen! But you can easily estimate the size of the Luna-PRO measuring area by comparison with the finder or groundglass image. The illustrations on page 10 show the relation for 35 mm cameras (24 x 36 mm) with various focal length lenses, and for $2^1/_4$ x $2^1/_4$" cameras, when reflected light measurements are made from the camera position.

The normal measuring area of the Luna-PRO corresponds to a light acceptance angle of 30°.

For 35 mm cameras (24 x 36 mm)



For 2¼ x 2¼" cameras

The normal measuring area of the Luna-PRO corresponds to a light acceptance angle of 30°. Still narrower angles (15° or 7.5°) can be measured when the Luna-PRO is used with the Variable Angle "spot meter" Attachment. (See page 17).

The small measuring areas permit very accurate, carefully aimed measurements for exposures with longer lenses, and selective readings of various parts of a scene or subject when normal lenses are used. The lively Indicator Needle of your Luna-PRO tells you very clearly whether a scene has uniform distribution of brightness or not. That's especially important for close-up measurements.

Incident Light Measurement (see also pages 3 and 5)

In this measuring method, your Luna-PRO "sees" only the light falling on that part of the scene which is facing the camera – in other words: the part which will be photographed. The result of this measurement does not consider the color or brightness of the scene itself. Thus, incident light measurement is ideal for the previous example with extensive very bright or very dark areas – it will give you perfect results.

Perfect Exposure

The correct exposure for any scene that can be photographed, can be determined with the Luna-PRO! But, when is a scene "perfectly" exposed? – That's not always so easy to

answer! For the amateur, especially the beginner, the over-all impression is usually decisive. But soon the demands become more stringent, especially when results are compared. "Perfect Exposure" normally means: The brightest portions of a color transparency, the darkest portions of a black-and-white print, should still show some detail!

For color slide or movie film – which, as you know, requires more critical exposure – the lighter portions of a scene usually determine the exposure. Therefore, keep an eye on such lighter areas and preferably expose a little shorter rather than longer, to get more brilliant colors.

For black-and-white or color negative film, however, the shadow portions which are to have some detail in the finished print must be given consideration. Therefore, watch the darker areas and expose a little longer rather than too little.

Most important: Be critical of your results! Analyze your prints and color transparencies for possible mistakes or errors in judgment. Learn from your experience: Failures properly analyzed will soon lead to consistent successes!

Remember that, when there are extreme contrasts in a scene, the film may not be able to cope with them! Don't blame your Luna-PRO! You will have to compromise with the limitations of the film by exposing a step more or less than indicated by the Luna-PRO. About "exposure steps" see page 26. However, it is easy to **give your Luna-PRO your Personal Touch** by harmonizing it with the tolerances of your camera, your favorite film, your developing methods (or those of your finisher). Here is how:

The Personal Touch

Do you really have to expose very critically every time? There are two answers to this question:

(1) On black-and-white or color negative film you will get good negatives almost without exception and without fuss.

(2) Reversal color film is more critical. Deviations from correct exposure will produce transparencies that are either too light or too dark; you may also get distortion of colors.

Now, you must remember that the accurate exposure information which your Luna-PRO gives you may not even be fully utilized because all sorts of "tolerances" must be reckoned with:

(a) The actual sensitivity of a film may differ from the one indicated on the film package.

(b) The actual speeds of your camera may differ from the values engraved on the shutter.

(c) The actual apertures may differ from those engraved on your camera f-stop scale.

(d) The film development may not always be identical.

(e) In addition, purely subjective considerations and matters of taste enter into the evaluation of the finished print or slide. If you make several exposures of the same scene or subject with various exposure times, you will almost never get complete agreement among different judges as to which negative or which slide received "perfect" exposure!

However, you can adapt **your** Luna-PRO exposure readings to the characteristics of **your** camera, **your** favorite film, **your** type of processing, **your** projector – in other words to **your personal touch.**

Use a reversal color film; select several "normal" scenes; take careful reflected and incident light measurements and shoot! But – each time make a series of 5 exposures; in addition to the one at the indicated exposure time, make one each at a full step and one-half step more and less than indicated by your Luna-PRO. Make complete notes of the readings and of any special conditions. When you have your finished transparencies, select the ones which, in your judgment, are "perfect" and compare them with your notes concerning exposure measurements, etc.

If they're O.K. – and in most cases they will be – everything is fine. Otherwise, determine by how much you need to increase or decrease future exposure readings to get the best results. With this adjustment you have then gained your "Personal Touch".

Sharpness for Motion and Depth of Field

After you have taken a light measurement, the computer scales of your Luna-PRO may line up something like this:

time	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8 sec.
f/	2	2.8	4	5.6	8	11	16	22

Eight combinations of which you may really use only one! Now, which combination might be "the best"? The Luna-PRO has done its best giving you so many equivalent pairs so that you may select a really suitable one. After all, a properly exposed picture must also be in sharp focus – which means that you have to ignore some aperture (f-stop) settings and some shutter speeds.

Motion calls for a short exposure to prevent a blurred image. (Your camera instruction book or any good photographic manual will give you information about "slowest permissible shutter speeds" for moving objects). Needless to say, sports pictures demand the shortest exposures (1/250 to 1/1000 sec.) and normal motion can be stopped with medium speeds 1/60 to 1/250 sec.) while, for still scenes, the slower speeds (1/30 to 1/4 sec.) are adequate. Of course, for the slow speeds, you'll need a good tripod or other camera support to avoid lack of sharpness due to camera shake.

Depth of Field. Since, usually, you will want to have near and distant objects equally sharp in your pictures, you'll have to "close down" the lens. How much? The depth-of-field scale of your lens, or a separate depth-of-field table will tell you. A smaller lens opening gives you the desired greater depth but – it calls for a longer exposure!

The conflicting demands of motion and depth of field reduce the choice of f-stops and shutter speeds to such an extent that, generally, only a few possible choices remain. Let's say you need a shutter speed of a least 1/60 sec. to stop motion in a scene and, to get adequate depth of field, you need a lens opening of f/5.6 or smaller. With the exposure reading shown opposite, you would only have the choice between using f/8 with 1/60 sec., or f/5.6 with 1/125 sec.

Occasionally you must make a compromise because existing light conditions may allow using neither the ideal f-stop nor the ideal shutter speed. On the one hand you risk subject motion; on the other, less depth of field – provided it is important to you to take the picture at all!

The Luna-PRO System

Thanks to its unique design as a SYSTEM EXPOSURE METER, your Luna-PRO provides you with an adaptability and universality previously unknown in exposure meters.

Used alone, the Luna-PRO continues the superb tradition of the Gossen Lunasix as the world's most sensitive, widest range (1 : 2,000,000) exposure meter. It converts instantly, and without accessories, from reflected to incident light measurement – and you'll find its one-hand operation (even with a glove on) a great boon when moments count on location, or in the studio.

Now, whenever the need arises, you can greatly expand the capabilities of the Luna-PRO by using one of the following exclusive accessory attachments:

Luna-PRO Variable Angle "spot meter" Attachment (see page 17)

Luna-PRO Enlarging Attachment (see page 18)

Luna-PRO Miscroscope/Telescope Attachment (see page 19)

Luna-PRO Flexible Fibre-Optics Attachment (see page 20)

An instant-lock-on device holds each attachment firmly on the Luna-PRO.

Variable Angle "spot meter" Attachment for the Luna-PRO

Although the normal 30° acceptance angle of the Luna-PRO is ideally suited for all-around use, you may want to measure smaller areas when using long telephoto lenses, or "spot" areas within the field covered by shorter lenses.

With the Variable Angle Attachment, the Luna-PRO takes readings of 15° and 7.5° measuring angles. The built-in reflex finder with delineated "target" areas lets you pick out the exact portion to be measured.

Thus, the Luna-PRO System gives you a practical choice of 30°, 15°, 7.5° angles for maximum versatility.

Enlarging Attachment for the Luna-PRO

Converts the Luna-PRO to an efficient enlarging exposure meter for black-and-white or color enlargements. It permits you to measure very small areas of the projected image for maximum utilization of paper contrast and color range. Built-in light conductor (instead of a mirror) for greater accuracy and efficiency.

Microscope/Telescope Attachment for Luna-PRO

A great aid in photomicrography. Fits the ocular tube of all microscopes for exact exposure determination.

Also ideal for light measurement of the aerial image in photography through terrestrial telescopes.

Flexible Fibre-Optics Attachment for Luna-PRO

Whether you use a reflex hand camera or a view camera – if it has a groundglass you can spot-read any small (abt. 3 mm) portion of the image for critical exposure measurement and determination of contrast range. The unique flexible probe lets you take readings even in the extreme corners and along the sides of the groundglass.

Your Gossen Luna-PRO

is a valuable precision instrument, made with great care and accurately calibrated. It deserves your good care! The enormous measuring range – down to faint moonlight – which you get in your Luna-PRO, is due to its unique photo resistor element. Like the highly sensitive nerves of your own eyes, the photo resistor should not be exposed **unnecessarily** to bright light for extended periods. While the element does not change its permanent properties under long exposure to light, it tends to retain the impression of light for a while. If the previous impression was "dark", you can be sure of utmost measuring accuracy. Therefore, always keep your Luna-PRO in its case when you are not actually using it!

The battery and zero position tests described on page 7 enable you to check the proper functioning of your Luna-PRO.

Measuring comparisons of your Luna-PRO with similar or other types of exposure meters cannot be made properly without special laboratory equipment (optical bench).

Do not attempt to open or repair your Luna-PRO. See Service information on following page.

Service

The Gossen Luna-PRO Electronic Exposure Meter is guaranteed to the original registered owner as shown on the guarantee certificate supplied with each new meter.

If repair or adjustment should become necessary, send the Luna-PRO (directly or through an authorized dealer) carefully packed, prepaid and accompanied by the original guarantee card to:

Gossen Service Department
Photo Tech Inc.
78 East 13th Street
New York, N.Y. 10003

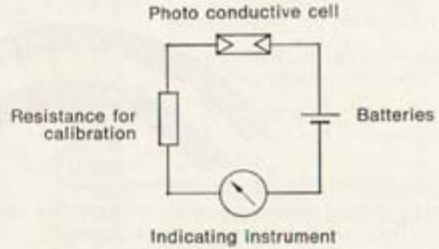
A brief description of the reason for sending the Luna-PRO should accompany the package

Technical Appendix

The Luna-PRO Principle

Unlike conventional exposure meters whose photoelectric cell consists of a selenium element, the Luna-PRO has a photo-conductive cell and is powered by tiny mercury batteries. While a selenium element converts light into electric energy, the photo-conductive cell merely changes its conductivity in the presence of light. The electrical energy which powers the precision mechanism of the Luna-PRO to deflect the indicator needle is here supplied by batteries.

Diagram of the Luna-PRO



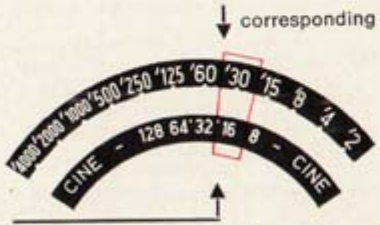
Reading the Scales

'2 '4 '8 etc. are fractions of seconds: 1/2 - 1/4 - 1/8 sec. etc.

Un-marked numerals 1, 2, 4 etc. are full seconds.

1m 2m 4m etc. are minutes

1h 2h 4h etc. are hours



Note: On certain motion picture cameras, the exposure time at normal speed (16 f.p.s.) is not 1/30 second. Check the instructions for your camera!

Speed Values

ASA Degrees	ASA Exposure Index	ASA Degrees	ASA Exposure Index
1°	**6**	7°	**400**
	8		500
1.5°	10	7.5°	650
2°	**12**	8°	**800**
	16		1 000
2.5°	20	8.5°	1 250
3°	**25**	9°	**1 600**
	32		2 000
3.5°	40	9.5°	2 500
4°	**50**	10°	**3 200**
	64		4 000
4.5°	80	10.5°	5 000
5°	**100**	11°	**6 400**
	125		8 000
5.5°	160	11.5°	10 000
6°	**200**	12°	**12 500**
	250		16 000
6.5°	320	12.5°	20 000
		13°	**25 000**

The ASA scales (4 and 16) show only the values listed here in bold types; the intermediate values are indicated by dots on the scales.

Doubling or halving an ASA Exposure Index value is equivalent to one step;

Increasing or decreasing the ASA Degree by 1 is equivalent to one step;

Increasing or decreasing the EV number by 1 is equivalent to one step.

When **exposure modification** is in order (see page 12), you simply choose one (and only one!) of the following adjustments:

For Example:		One Step **More** Exposure	One Step **Less** Exposure
If **actual** Luna-PRO reading is:		requires a **change** to:	
Indicator Scale	16	15	17
EV Scale	10	9	11
Shutter Speed	1/30	1/15	1/60
Lens Aperture	f/5.6	4	8

Note: The ASA setting remains unchanged.

Calibration Data

The table on the back of the Luna-PRO shows the calibration data according to American Standard ASA PH 2.12-1961. These are the footcandle and lux values (1 ft-c = 10.76 Lux) corresponding to the Luna-PRO scale readings obtained by the **incident light measurement** method. The Luna-PRO should not be considered a full-fledged footcandle meter because, strictly speaking, footcandles of illumination can be measured only by means of a flat interception screen. The Luna-PRO is equipped with a spherical diffusing screen and thus

achieves superior collection of the photographically effective illumination: Photographic subjects are usually three-dimensional and they are illuminated from many different directions (sun, sky, reflections from buildings, trees, ground, etc.). However, the footcandle table can be of practical value for measuring direct light beams (arc light, spots).

For **reflected light measurement,** footcandle values cannot be given at all, since this method measures not the illumination but the brightness of the surface (field luminance) which can be expressed in footlamberts. The measured values for reflected light measurement expressed in footlamberts are approx. 7.5 times smaller than the footcandle values with incident light measurement. Example:

Indicator scale reading	Incident light (illumination in footcandle)	Reflected light (field luminance in footlamberts)
1	.016	.0021
2	.032	.0042
3	.065	.0084
4	.13	.017